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SEROLOGICAL ANALYSIS OF LEPERS' SERA

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The serological studies in leprosy, as far as evident from the available literature,[2] can be divided into several groups.

The first group includes specific immune reactions where lepers' sera and extracts or suspensions of leprous tissues rich in lepra bacilli were used for agglutination, opsonin, or complement fixation reactions.

In the second group are reactions in which lepers' sera were tested against nonspecific antigens such as are or were used in serodiagnosis of syphilis (precipitation or complement fixation).

Immune reactions, where acid-fast bacilli other than *Bacillus lepræ* or their extracts were used as antigen, make the third group.

In the fourth group belong reactions in which nonacid-fast bacteria or their extracts were employed.

The fifth group comprises physical or physicochemical tests, such as the meiostagmin and the globulin precipitation tests.

Furthermore, there are stray statements in the literature on serology of leprosy to which apparently little attention has been paid by the experimenters. Such, for instance, are the frequently found statements that lepers' sera are anticomple-

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[2] Jadassohn, J., Handbuch der Pathogenen Mikroorganismen. W. Kolle and A. v. Wassermann, 2. Aufl. 5 (1913).

mentary or become so upon storage; that lepers' sera, like those of late syphilitics, lack complement, but that the erythrocytes of the lepers, unlike those of late syphilitics, show normal susceptibility to hæmolysis. These statements appear immaterial at first sight, particularly because the evidence on which they are based is either not given in the respective papers or is insufficient. Nevertheless, if true, these findings may help to work out a combination of nonspecific reaction that might be useful in serodiagnosis of leprosy.

The Wassermann reaction was the one most extensively investigated in leprosy. The majority of authors agree that this reaction is positive in leprosy, in a certain percentage of cases at least. Numerous authors give a percentage of positive cases varying from 0 to 90 per cent, or over. The method employed is frequently not given in detail and the number of patients investigated is often too small. Furthermore, the fact remains undisputed that many of the positive lepers may have syphilis. It is reasonable to suppose that, in countries where leprosy is prevalent, the percentage of syphilitics among lepers will be as high at least as among nonlepers, so that the actual percentage of nonsyphilitic lepers who gave positive Wassermann reaction cannot be definitely estimated, even in one and the same locality, because it is impossible to eliminate a syphilitic infection on the mere denial of the patient, in the absence of syphilitic manifestations. The prevalence of yaws in a community further complicates the situation.

To illustrate the possibility of combining two or three nonspecific immune reactions in a diagnosis of leprosy, we give the following example.

There is a statement quoted in the literature [3] that lepers' sera, like those of paralytics, lack hæmolytic complement. If this be true, an adjuvant serological method would be available, particularly in view of another statement found in the literature [4] that the red corpuscles of lepers are equally susceptible to hæmolysis by cobra poison as are those of normal persons, while the red corpuscles of late syphilitics (paralytics) are considered to be resistant to hæmolysis by cobra venom. It is at once evident that certain given cases, at least, in which

[3] Eliasberg, J., Deutsche Med. Wchnschr. Nr. 44 (1909) 1922.

[4] Jadassohn, J., Handbuch der Pathogenen Mikroorganismen. W. Kolle and A. v. Wassermann, 2. Aufl. 5 (1913) 837.

suspicious skin manifestations are found could very probably be differentiated as being lepers and not syphilitics, or vice versa.

But examination of the evidence for these statements reveals that the quotation from Weil's article is not correct, but that the statement that lepers' sera lack complement is supported by experimental evidence; and the contradictory statement attributed to Duval in the paper quoted, that lepers' sera contain complement, lacks all experimental evidence.

It would naturally seem that the findings of Eliasberg (who is responsible for the statement that leper serum lacks complement) may probably stand in relation with the statements by other authors who claim that leper serum is anticomplementary, or becomes so on storage. Here again we are searching in vain for the details, such as whether the sera were stored with the blood clot or without the blood clot, after inactivation or before inactivation.

In view of these contradictory or deficient statements in the serological literature on leprosy, and in view of our recent investigations [5] we decided to make a survey of the serological properties of leper sera as compared with sera of normal individuals.

The present investigation has for its objects to determine:

1. The content of the normal complement-hæmolysin complex in the lepers' sera toward the red corpuscles of guinea pigs, rabbits, sheep, and goats as compared with sera of normal individuals.

2. The hæmolytic complement content of the lepers' sera as compared with normal sera tested against the antimonkey and antisheep hæmolytic system.

3. The keeping quality of the hæmolytic complement in lepers' sera and in normal sera.

TECHNIC

NATURAL HÆMOLYSIN AND NATURAL COMPLEMENT CONTENT IN NORMAL AND LEPROUS HUMAN SERA TOWARD RED CELLS OF GUINEA PIGS

The reagents used were fresh human sera and guinea pig red blood corpuscles, 2 per cent suspension in physiological saline (washed and unwashed).

[5] Philip. Journ. Sci. 25 (1925) 1.

The preparation of reagents was as follows:

Human sera.—A sufficient amount of blood was withdrawn from the cubital vein of the patient by means of a sterile syringe, and was then placed in a sterile tube and allowed to clot at room temperature; as soon as the serum separated it was pipetted off and centrifuged. The lepers' sera were used not later than three hours after the blood had been taken and the control sera were usually one or two hours older than the lepers' sera.

Guinea pig red blood corpuscles.—These were washed before using, but in the preliminary titration unwashed corpuscles were used also. Several cubic centimeters of blood were taken from the guinea pig's heart by puncture; a part of the blood was placed in a sufficient amount of normal salt solution to make a 2 per cent suspension. The rest was mixed with an equal volume of sodium citrate solution, centrifuged, washed four times with physiological salt solution, and a 2 per cent emulsion in physiological salt solution was made.

Preliminary tests to find the approximate complement content in normal human sera indicated that 0.3, 0.2, and 0.1 cubic centimeter are the desirable quantities to use.

In the actual test the following amounts of fresh human serum were used. To 0.1, 0.2, and 0.3 cubic centimeter of fresh human serum a sufficient amount of physiological salt solution was added to make the total volume 1 cubic centimeter; then 1 cubic centimeter of a 2 per cent guinea pig red corpuscle suspension was added, and the tubes were incubated at 37° C. Readings were taken after fifteen, thirty, and sixty minutes incubation. Further details are given in Table 1.

NATURAL HÆMOLYSIN AND COMPLEMENT CONTENT IN LEPERS' SERA AGAINST SHEEP, GOAT, AND RABBIT RED CORPUSCLES AS COMPARED WITH SERA OF NORMAL PERSONS

To 0.3 cubic centimeter of fresh human serum, or to 0.2 cubic centimeter of human serum heated at 58° C. for a half hour, a sufficient amount of physiological salt solution was added to make 1 cubic centimeter, and 0.5 cubic centimeter of a 4 per cent emulsion of washed red cells of the respective animals was added. The mixture was incubated for a half hour and then 0.5 cubic centimeter of a 0.1 guinea pig complement was added to the inactivated sera, incubated, and read after fifteen,

thirty, and sixty minutes at 37° C., and eighteen hours in the ice chest.

NATURAL COMPLEMENT OF LEPERS' SERA AND ANTIMONKEY HÆMOLYTIC SYSTEM

Fresh lepers' sera were used in the amounts of 0.3, 0.5, and 0.7 cubic centimeter, respectively, and the volume was made up to 1 cubic centimeter by adding physiological salt solution. One cubic centimeter of 5 per cent washed monkey red corpuscles, sensitized for thirty minutes with two units of amboceptor, was then added and readings taken at the intervals of time indicated in Table 4. Incubation took place at 37° C.

THE KEEPING PROPERTY OF NATURAL HÆMOLYTIC COMPLEMENT IN LEPERS' SERA AND SERA OF NORMAL PERSONS

The serum was obtained in the usual manner and the test was commenced as soon as the serum separated; that is to say, within two to three hours after the blood was withdrawn. In two test tubes were placed 0.5 and 0.7 cubic centimeter of the serum, respectively, and the total amount was made up to 1 cubic centimeter by the addition of physiological salt solution. Then 1 cubic centimeter of washed monkey red cells, sensitized with two units of amboceptor, was added. Incubation followed at 37° C. and readings were made after fifteen, thirty, and sixty minutes incubation. Part of each serum was kept in the refrigerator for twenty-four hours, and the test was then repeated in the manner just described.

THE RESULTS OF THE EXPERIMENTS

In Table 1 the results of tests of sera of twenty lepers and twenty nonlepers are given. It can be seen that complete hæmolysis of guinea pig washed corpuscles took place practically in every instance when 0.3 cubic centimeter of lepers' fresh sera was used. When smaller quantities were employed individual variations became apparent. It is further evident that the quantitative variations are more pronounced in the sera of nonlepers than in those of lepers.

In Table 2 the results of tests with twelve lepers and five normal persons as to the absence or presence of normal antisheep and antigoat hæmolysins and complement are given. In the case of antisheep and antigoat normal hæmolysin-complement com-

plex the individual quantitative differences are more pronounced than in the case of guinea pig red cells, but they are as pronounced in lepers' sera as they are in normal sera.

In Table 3 the results of examination of twelve lepers and seven normal persons are tabulated. Comparatively slight individual variation in the amount of antirabbit normal hæmolysin and complement were found alike in lepers' sera and in normal sera. Agglutination of rabbit red corpuscles by heated human sera, and in a few instances by unheated sera, took place regularly without any noteworthy quantitative differences.

Table 4 shows the results of tests conducted with the view to ascertain the existence, nonexistence, or deficiency of hæmolytic complement in fresh lepers' sera as compared with normal sera. Two units of antimonkey amboceptor were used in these experiments. By a unit we mean the minimal amount of antimonkey amboceptor which dissolves completely 1 cubic centimeter of 5 per cent monkey red corpuscles in thirty minutes. The antimonkey amboceptor was preferable, because it is known that human sera do not contain antimonkey normal hæmolysin.

Altogether thirty lepers and eight controls were subjected to this test. Quantitative variations of the natural complement in lepers' sera and in normal human sera alike are evident from Table 4. In one instance of lepers' sera (55) there was no hæmolysis at all, due to the strong agglutination of red corpuscles. When antisheep hæmolytic system was used and fresh human serum as complement (Table 5) hæmolysis was more constant and the individual variations were slighter. This is not surprising, in view of the fact that fresh human serum, which served as complement in this test, contains besides complement also natural antisheep amboceptor. Again we failed to find any difference between lepers' sera and normal human sera.

Six lepers' sera and three normal human sera were used in the test for keeping quality of human natural hæmolytic complement. The lepers' sera incidentally showed low complement content. Stored at 9° C., the sera that showed high complement content decreased more than did those that showed low content of the hæmolytic complement. Lepers' sera and normal human sera behaved practically the same way in this respect.

SUMMARY AND CONCLUSIONS

Ninety-two lepers were examined serologically with the view to deciding certain doubtful points in the serology of leprosy.

The question of complement and natural hæmolysin content in lepers' sera toward guinea pig, sheep, goat, and rabbit red cells was investigated. The content of hæmolytic complement and its keeping quality in the lepers' sera were studied, anti-sheep and antimonkey immune hæmolysin having been used in these tests.

Slight individual differences were found to exist in lepers' sera and in normal human sera alike as to content of natural hæmolysins and complement, but no distinct quantitative differences were found between the sera of lepers and those of normal persons. The amount of hæmolytic complement in the lepers' sera was found to be the same as that in the sera of nonlepers and is subject to individual variations.

As to the keeping quality of the natural hæmolytic complement, it was found that, in proportion to the original titer, the complement decreased practically at the same rate in the sera of lepers as it did in the sera of normal individuals.

In the tables in this paper, the following symbols are used:

± = trace of hæmolysis.
\+ = weak hæmolysis.
\+\+ = moderate hæmolysis.
\+\+\+ = strong hæmolysis.
\+\+\+\+ = very strong hæmolysis.
— = no hæmolysis.
0 = not done.
? = unknown.

TABLE 1.—*Showing the results of tests for natural hæmolysin and natural complement content of lepers' sera toward guinea pig red corpuscles.*

No. and name of patient.	Sex and age.	Form of leprosy.	Duration of treatment.	Amount of serum.			Time of incubation.	Remarks.
				0.1 cc.	0.2 cc.	0.3 cc.		
Lepers:							*Minutes.*	
1, T. N.		Tubercular	One month	++	++++	++++	15	
				++	++++	++++	30	
				+++	++++	++++	60	
2, G. J.		Macular	Three months	++	++++	++++	15	
				++	++++	++++	30	
				+++	++++	++++	60	
3, M. P.		Tubercular	Three weeks	++	++++	++++	15	
				++	++++	++++	30	
				++	++++	++++	60	
4, G. V.		Anæsthetic	Six and a half months	++	++++	++++	15	
				++	++++	++++	30	
				++	++++	++++	60	
5, M. G.		Macular tubercular	Three months		++	++++	15	
					++	++++	30	
					+++	++++	60	
6, S. T.		Tubercular	Three and a half months	++	++++	++++	15	
				++	++++	++++	30	
				+++	++++	++++	60	
7, D. V.		Macular tubercular	One month	+++	++++	++++	15	
				+++	++++	++++	30	
				+++	++++	++++	60	
8, C. G.		Tubercular ichthyosis	do	++	++++	++++	15	
				++	++++	++++	30	
				++	++++	++++	60	
9, M. C.		Macular tubercular	Five days	—	+++	++++	15	
				—	+++	++++	30	
				+	++++	++++	60	

10, A. M.		Macular	Two months	++	15
				+++	30
				++	60
11, M. R.		do	Two weeks	+	15
				+	30
				+	60
12, A. G.		Macular tubercular	Four months	+	15
				+	30
				+	60
13, P. V.		Macular	(?)	+	15
				+	30
				+	60
14, F. C.		do	(?)	+	15
				+	30
				+	60
15, D. L.		do	(?)	+	15
				+	30
				+	60
16, D. Z.		do	(?)	+	15
				+	30
				+	60
17, P. L.		Macular tubercular	(?)	+	15
				+	30
				+	60
18, F. C.		do	Three months	++	15
				++	30
				++	60
19, P. M.		Anæsthetic	Two months	+	15
				+	30
				+	60
20, T. A.		Macular	Five months	+	15
				+	30
				+	60

TABLE 1.—*Showing the results of tests for natural hæmolysin and natural complement content of lepers' sera toward guinea pig red corpuscles*—Continued.

No. and name of patient.	Sex and age.	Form of leprosy.	Duration of treatment.	Amount of serum.			Time of incubation.	Remarks.
				0.1 cc.	0.2 cc.	0.3 cc.		
Controls:							*Minutes.*	
1, M. D.[a]	Female, adult			—	+++	++++	15	Wassermann negative.
				±	+++	++++	30	
				+++	++++	++++	60	
2, J. G.[a]	Male adult			—	—	+	15	Do.
				—	—	++	30	
				++	+++	++++	60	
3, U. L.[a]	Female, adult			—	+++	++++	15	Do.
				—	+++	++++	30	
				+	++++	++++	60	
4, M. A.[a]	do			+	++++	++++	15	Do.
				++	++++	++++	30	
				+++	++++	++++	60	
5, Dr. J. R.[a]	23 years			—	—	+	15	Do.
				—	++	+++	30	
				±	+++	++++	60	
6, Dr. S.[b]	48 years			+	++	+++	15	
				+	++	+++	30	
				+	+++	++++	60	
7, P. C.[a]	24 years			±	+++	++++	15	
				±	+++	++++	30	
				±	++++	++++	60	
8, P. A.[a]	22 years			±[c]	+	+++	15	
				±	+	+++	30	
				±	+	++++	60	
9, F. L.[a]	28 years			—	—	±	15	
				—	—	±	30	
				—	+	+++	60	

10, A. R.[a]	19 years			—[c]	+	+++	15	
				—	+	+++	30	
				±	+	++++	60	
11, D.[a]	24 years			+	+++	++++	15	
				+	+++	++++	30	
				++	++++	++++	60	
12, F. V.[a]	32 years			—	+	++++	15	Wassermann negative.
				—	+	++++	30	
				±	++	++++	60	
13, N. V.[d]	Male, adult			—	+	++++	15	Do.
				—	+	++++	30	
				±	++	++++	60	
14, Dr. A. V.[a]				—	+	+	15	Do.
				±	+	++++	30	
				+	++	++++	60	
15, C. C.[a]	24 years			+++	++++	++++	15	Do.
				+++	++++	++++	30	
				++++	++++	++++	60	
16, F. M.[a]	do			++	++++	++++	15	Do.
				+++	++++	++++	30	
				++++	++++	++++	60	
17, Mr. L.[d]				—	+++	++++	15	Do.
				—	+++	++++	30	
				—	+++	++++	60	
18, E. ?[a]	30 years			—	++	+++	15	Do.
				—	+++	+++	30	
				±	+++	+++	60	
19, M. B.[d]	Male, adult			—	+	+	15	Wassermann + positive.
				—	+++	++++	30	
				—	+++	++++	60	
20, N. B.[a]	31 years			—	+++	++++	15	
				+	+++	++++	30	
				++	++++	++++	60	

[a] Filipino. [b] European. [c] Agglutination. [d] American.

TABLE 2.—*Showing the results of tests for natural hæmolysin and natural complement content of lepers' sera toward sheep and goat red cells.*

No. and name of patient.	Form of leprosy.	Duration of treatment.	Sheep red cells, 4 per cent.		Goat red cells, 4 per cent.		Time of incubation.	Remarks.
			0.2 cc. serum heated complement 0.1.	0.3 cc. serum unheated.	0.2 cc. serum heated complement 0.1.	0.3 cc. serum unheated.		
							hrs. min.	
Lepers:								
30, V. R.	Macular	Two and a half years	—	++++	—	++++	30	Wassermann negative.
			—	++++	—	++++	60	
			—	++++	±	++++	18	Ice box.
31, L. M.	Macular anæsthetic	One year	—	++++	—	++++	30	Wassermann + positive.
			—	++++	—	++++	60	
			—	++++	+	++++	18	Ice box.
32, A. F.	Macular tubercular	Eleven months	—	—	—	+	30	Wassermann negative.
			—	++	—	+++	60	
			—	++	+	+++	18	Ice box.
33, F. V.	Macular	Six months	—	++++	—	++++	30	Wassermann negative.
			—	++++	—	++++	60	
			—	++++	+	++++	18	Ice box.
34, P. L.	do	Five months	—	++++	—	++++	30	Wassermann negative.
			—	++++	—	++++	60	
			—	++++	++	++++	18	Ice box.
35, E. A.	Macular tubercular	Three years	++	++++	++++	++++	30	Wassermann negative.
			++	++++	++++	++++	60	
			++	++++	++++	++++	18	Ice box.
36, A. T.	Tubercular	Four months	—	++++	—	++++	30	Wassermann + positive.
			+	++++	++++	++++	60	
			+	++++	++++	++++	18	Ice box.

37, B. G.	do	Four and a half months	—	++++	—	++++		30	Wassermann negative.
			++	++++	++	++++		60	
			++	++++	+++	++++	18		Ice box.
38, S. G.	Macular tubercular	Four months	—	++++	—	++++		30	Wassermann 0.
			+++	++++	++++	++++		60	
			++++	++++	++++	++++	18		Ice box.
39, F. del R.	do	Three weeks	—	++++	—	++++		30	Wassermann negative.
			+	++++	++	++++		60	
			++	++++	+++	++++	18		Ice box.
40, P. M.	Tubercular	Six months	—	—	—	±		30	Wassermann negative.
			—	±	—	++		60	
			—	+	—	+++	18		Ice box.
41, B. de G.	Macular	Eighteen months	±	++++	+	++++		30	Wassermann negative.
			+++	++++	++++	++++		60	
			+++	++++	++++	++++	18		Ice box.
Controls:									
1, Dr. S.			+++	++++	+	++++		30	Wassermann negative.
			++++	++++	++++	++++		60	
			++++	++++	++++	++++	18		Ice box.
2, F. M.			±	++++	±	++++		30	Wassermann negative.
			++++	++++	++++	++++		60	
			++++	++++	++++	++++	18		Ice box.
3, C. C.			±	++++	±	++++		30	Wassermann negative.
			+	++++	++	++++		60	
			+++	++++	+++	++++	18		Ice box.
4, Dr. R.			—	—	—	±		30	Wassermann negative.
			—	—	—	±		60	
			—	++	—	++	18		Ice box.
15.			+	++++	++++	++++		30	
			+	++++	++++	++++		60	
			++	++++	++++	++++	18		Ice box.
5, Dr. P.			—	++++	++	++++		30	Wassermann negative.
			—	++++	++	++++		60	
			++	++++	+++	++++	18		Ice box.

TABLE 3.—*Showing the results of tests for natural hæmolysin and natural complement toward rabbit red cells.*

No. and name of patient.	Form of leprosy.	Duration of treatment.	Rabbit red cells, 4 per cent.		Time of incubation.	Remarks.
			0.2 cc. serum heated complement 0.1.	0.3 cc. serum unheated.		
					hrs. min.	
Lepers:						
42, B. R.	Macular tubercular	Nine months	—[a]	++	15	Wassermann negative.
			—[a]	+++	30	
			—[a]	+++	60	
			—[a]	+++[a]	18	Ice box.
43, M. B.	Macular	Four months	—[a]	+++	15	Wassermann negative.
			—[a]	++++	30	
			—[a]	++++	60	
			—[a]	++++	18	Ice box.
44, F. B.	do	One day	—[a]	++++	15	Wassermann negative. Agglutination before and after addition of complement.
			—[a]	++++	30	
			—[a]	++++	60	
			—[a]	++++	18	Ice box.
45, R. V.	do	Ten months	—[a]	++++	15	Wassermann negative.
			—[a]	++++	30	
			—[a]	++++	60	
			—[a]	++++	18	Ice box.
46, S. A.	do	Two months	—[a]	++	15	Wassermann negative.
			—[a]	+++	30	
			—[a]	+++	60	
			—[a]	+++[a]	18	Ice box.
47, G. V.	do	Seven months	—[a]	++++	15	Wassermann negative.
			—[a]	++++	30	
			—[a]	++++	60	
			—[a]	++++	18	Ice box.

48, R. G.	Macular tubercular	Ten days	—[a]	++	15	Wassermann negative.
			—[a]	+++	30	
			±[a]	++++	60	
			±[a]	++++	18	Ice box.
49, G. A.	do	Ten hours	—[a]	++++	15	Wassermann negative. Agglutination before and after addition of complement.
			—[a]	++++	30	
			±[a]	++++	60	
			+	++++	18	Ice box.
50, A. P.	do	Two weeks	—[a]	+	15	Wassermann negative.
			—[a]	+	30	
			±[a]	++	60	
			+[a]	+++	18	Ice box.
51, E. C.	do	Eight days	—[a]	++++	15	Wassermann negative.
			—[a]	++++	30	
			±[a]	++++	60	
			+[a]	++++	18	Ice box.
52, D. C.	Tubercular	One and a half years	—[a]	++++	15	Wassermann negative.
			—[a]	++++	30	
			±[a]	++++	60	
			+[a]	++++	18	Ice box.
53, T. H.	Macular	Two years	—[a]	++++	15	Wassermann negative.
			—[a]	++++	30	
			±[a]	++++	60	
			+[a]	++++	18	Ice box.
Controls:						
1, Dr. R.			—[a]	++++	15	Wassermann negative.
			—[a]	++++	30	
			±[a]	++++	60	
			+[a]	++++	18	Ice box.
2, Mr. L.			—[a]	+++	15	Wassermann negative.
			—[a]	+++	30	
			±[a]	++++	60	
			+[a]	++++	18	Ice box.

[a] Agglutination.

TABLE 3.—*Showing the results of tests for natural hæmolysin and natural complement toward rabbit red cells*—Continued.

No. and name of patient.	Form of leprosy.	Duration of treament.	Rabbit red cells, 4 per cent.		Time of incubation.	Remarks.
			0.2 cc. serum heated complement 0.1.	0.3 cc. serum unheated.		
Lepers:					*hrs. min.*	
3, A. I.			—[a]	+++	15	Wassermann negative.
			—[a]	+++	30	
			±[a]	++++	60	
			+[a]	++++	18	Ice box.
4, A. Q.			—[a]	+++	15	Wassermann + positive.
			—[a]	+++	30	
			±[a]	++++	60	
			+[a]	++++	18	Ice box.
5, F. G.			—[a]	+	15	Wassermann + positive.
			—[a]	+	30	
			±[a]	++	60	
			+[a]	+++	18	Ice box.
6, Dr. O. G.			—[a]	++++	15	Wassermann negative.
			—[a]	++++	30	
			—[a]	++++	60	
			—[a]	++++	18	Ice box.
7, Dr. S.			—[a]	++++	15	Wassermann negative.
			—[a]	++++	30	
			+[a]	++++	60	
			+[a]	++++	18	Ice box.

[a] Agglutination.

TABLE 4.—*Showing the results of tests for natural hæmolytic complement of lepers' sera and antimonkey hæmolytic system.*

No. and name of patient.	Form of leprosy.	Duration of treatment.	Amount of serum.	Hæmolysis in 1 hour.	Remarks.
Lepers:			*cc.*		
54, D. V.	Macular tubercular	One month	0.3	+	
			0.5	++	
55, C. G.	Tubercular ichthyosis	do	0.3	—	Very strong agglutination.
			0.5	—	
56, M. C.	Macular tubercular	Five days	0.3	—	
			0.5	+++	
57, A. M.	Macular	Two months	0.3	++	
			0.5	+++	
58, M. R.	do	Two weeks	0.3	+++	
			0.5	+++	
59, A. G.	Macular tubercular	Four months	0.3	+	
			0.5	++	
60, R. D.	Macular	(?)	0.5	0	
			0.7	++++	
61, P. V.	do	(?)	0.5	++++	Wassermann negative.
			0.7	++++	
62, F. C.	do	(?)	0.5	++++	Do.
			0.7	++++	
63, D. L.	do	(?)	0.5	++++	Do.
			0.7	++++	
64, D. Z.	do	(?)	0.5	++++	Do.
			0.7	++++	
65, P. L.	Macular tubercular	(?)	0.5	++++	Do.
			0.7	++++	
66, J. F.	do	Five months	0.5	++++	Do.
			0.7	++++	
67, G. V.	do	Seven months	0.5	++	Do.
			0.7	++	

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TABLE 4.—*Showing the results of tests for natural hæmolytic complement of lepers' sera and antimonkey hæmolytic system*—Continued.

No. and name of patient.	Form of leprosy.	Duration of treatment.	Amount of serum.	Hæmolysis in 1 hour.	Remarks.
Lepers:			*cc.*		
68, L. P.	Macular tubercular	Eight months	0.5	++	Wassermann negative.
			0.7	++	
69, A. U.	Macular	Nine months	0.5	++	Wassermann 0.
			0.7	0	
70, I. D.	do	Six months	0.5	++++	Wassermann negative.
			0.7	++++	
71, S. C.	Macular tubercular	do	0.5	++++	Do.
			0.7	++++	
72, F. V.	Tubercular	Two and a half months	0.5	+	Do.
			0.7	+	
73, F. C.	Macular tubercular	Three months	0.5	++++	Do.
			0.7	++++	
74, P. M.	Anæsthetic	Two months	0.5	+++	Do.
			0.7	+++	
75, T. M.	Macular tubercular	One week	0.5	++++	Do.
			0.7	++++	
76, T. A.	Macular	Five months	0.5	++++	Do.
			0 7	++++	
77, S. S.	Anæsthetic	Eight months	0.5	++++	Do.
			0.7	++++	
78, S. K.	Macular	Four days	0.5	++	Wassermann ± positive.
			0.7	++	
79, L. R.	Macular tubercular	Eleven days	0.5	+++	Wassermann negative.
			0.7	+++	
80, P. R.	do	Ten months	0.5	++++	Do.
			0.7	++++	

81, J. C.	Macular	Nine months	0.5	+++	Do.
			0.7	+++	
82, V. R.	Macular tubercular	Seven months	0.5	++++	Do.
			0.7	++++	
83, P. A.	do	Two years	0.5	++++	Do.
			0.7	++++	
Controls:					
1, Dr. S.			0.3	++++	
			0.5	+++	
2, Dr. R.			0.3	+	
			0.5	++	
3, C. C.			0.3	+	
			0.5	++	
4, F. M.			0.3	+	
			0.5	++	
5, Mr. L.			0.5	++++	
			0.7	++++	
6, B. A.			0.5	++++	
			0.7	++++	
7, Z. P.			0.5	+++	Wassermann negative.
			0.7	+++	
8, J. T.			0.5	++++	Wassermann ++++ positive.
			0.7	+++	

TABLE 5.—*Showing the results of tests for natural complement of lepers' sera and antisheep hæmolytic system.*

No. and name of patient.	Form of leprosy.	Duration of treatment.	Amount of serum.	Hæmolysis in thirty minutes.
Lepers:			*cc.*	
			0.1	++
			0.2	++++
84, D. V.	Macular tubercular	Three months	0.4	++++
			0.6	++++
			0.8	++++
			0.1	+
			0.2	++++
85, A. M.	Macular	Four months	0.4	++++
			0.6	++++
			0.8	++++
			0.1	++++
			0.2	++++
86, A. G.	Macular tubercular	Six months	0.4	++++
			0.6	++++
			0.8	++++
			0.1	++++
			0.2	++++
87, F. C.	Macular	(?)	0.4	++++
			0.6	++++
			0.8	++++
			0.1	—
			0.2	++
88, D. Z.	do	(?)	0.4	++++
			0.6	++++
			0.8	++++
			0.1	++++
			0.2	++++
89, P. L.	Macular tubercular	(?)	0.4	++++
			0.6	++++
			0.8	++++
			0.1	++++
			0.2	++++
90, S. C.	do	Two weeks	0.4	++++
			0.6	++++
			0.8	++++
			0.1	++
			0.2	+++
91, S. S.	do	Three weeks	0.4	++++
			0.6	++++
			0.8	++++
			0.1	++++
			0.2	++++
92, S. S.	do	One week	0.4	++++
			0.6	++++
			0.8	++++
			0.1	+++
			0.2	++++
93, M. M.	Tubercular anæsthetic	Six weeks	0.4	++++
			0.6	++++
			0.8	++++

TABLE 5.—*Showing the results of tests for natural complement of lepers' sera and antisheep hæmolytic system*—Continued.

No. and name of patient.	Form of leprosy.	Duration of treatment.	Amount of serum.	Hæmolysis in thirty minutes.
Lepers:			*cc.*	
			0.1	+++
			0.2	++++
94, S. R.	Macular tubercular	Two weeks	0.4	++++
			0.6	++++
			0.8	++++
			0.1	+++
			0.2	++++
95, S. C.	do.	Three weeks	0.4	++++
			0.6	++++
			0.8	++++
Controls:				
			0.1	++++
			0.2	++++
1, P. C.			0.4	++++
			0.6	++++
			0.8	++++
			0.1	++++
			0.2	++++
2, D.			0.4	++++
			0.6	++++
			0.8	++++
			0.1	+++
			0.2	++++
3, Dr. S.			0.4	++++
			0.6	++++
			0.8	++++
			0.1	—
			0.2	+
4, Dr. R.			0.4	++++
			0.6	++++
			0.8	++++
			0.1	++
			0.2	++++
5, B. A.			0.4	++++
			0.6	++++
			0.8	++++
			0.1	+++
			0.2	++++
6, A. R.			0.4	++++
			0.6	++++
			0.8	++++

TABLE 6.—*Showing the results of tests of keeping quality of natural hæmolytic complement upon storage at low temperature (9° C.).*

No. and name of patient.	Form of leprosy.	Duration of treatment.	Amount of serum.	Immediate incubation (minutes).			After twenty-four hours (minutes).		
				15	30	60	15	30	60
Lepers:			*cc.*						
96, R. Z.	Macular	Twelve days.	0.5	++	++	++	—	+	+
			0.7	++	++	+++	—	++	++
97, E. D.	Anæsthetic	Nine months.	0.5	++	++	++	—	—	±
			0.7	++	++	++	—	+	+
98, F. D.	Tubercular	One day.	0.5	++	++	++	—	+	+
			0.7	++	++	+++	—	++	++
99, T. U. T.	Macular	Six days.	0.5	—	—	—	—	—	±
			0.7	—	±	±	—	±	±
100, H. Z.	Macular tubercular	One day.	0.5	++	++	++++	—	+	++
			0.7	+++	+++	++++	—	++	++
101, M. R.	do.	Fourteen days.	0.5	++	++	++++	—	++	++
			0.7	++	++	++++	±	+++	+++
Controls:									
1, J.			0.5	++	++	++++	—	+	++
			0.7	+++	+++	++++	—	++	+++
2, R.			0.5	++	++	++++	—	+	++
			0.7	+++	+++	++++	—	++	+++
3, S.			0.5	++	++	++++	—	+	++
			0.7	+++	+++	++++	—	++	+++

EFFECT OF CASTRATION UPON PULLING POWER AND ENDURANCE IN GUINEA PIGS

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INTRODUCTION

The question as to what effect castration (complete and artificial removal of sex glands in the male) has on the pulling power and endurance of an animal has received very little attention. The experiments here reported were carried out in an attempt to gain some information on the subject; they were planned to supplement my previous work.(7) The data furnished by the present study, though perhaps not conclusive, especially as to other animals, may be valuable as reference for further investigation along this line.

Concerning the influence of castration upon the endurance and strength of work animals in pulling loads, two decidedly opposite views have prevailed, and they still prevail, among Filipino live stock owners. According to some, castrated animals are generally stronger than entire animals and have more endurance in pulling loads; others hold that the effect of castration is exactly the reverse. The belief that removal of the testes lowers the strength and endurance of animals in performing labor constitutes one of the reasons why, in the Philippines, castration is objected to by many owners.

From a survey of the available literature bearing on the influence of castration in experimental animals, made in connection with preparation of the paper on the effects of the operation in immature guinea pigs,(7) it was found that the attention of investigators has been focused principally upon the structural changes that other endocrin glands undergo after the operation, and on determining what functional relation exists between the sex glands and other members of the endocrin system, particularly in regard to the full physical development of the body and of the sexual characteristics. In work animals, so far as I am aware, no systematic study has been carried out

to determine the changes, if any, incident to the operation, and castration in such animals is performed primarily for two economic reasons: According to Thompson,(8) to render the animals more docile and easy to manage; and according to Shaw,(4) to render them sterile so that selection for breeding purposes can be made easily.

Search of the literature failed to give substantial information, even on experimental animals, concerning the effect of castration on the animal's endurance and pulling power. The only investigators who refer to the subject are Shimamura and Matsuba;(5) their paper contains the following statements: "The castrated animals were generally stronger in pulling weight. The inferiority of the pulling power in the controls may probably be due to their restless behaviour."

On horses Hays's(2) personal observation is perhaps worthy of notice. He states in part that—

> * * * entires, which, as a rule have heavier necks than geldings, do not, when they are employed at fast paces, stand as much work, retain their form as long, or get into galloping condition as quickly as those which have been added to the list [referring to the geldings added to the list of horses employed at one time in England in steeple-chasing and racing]. * * * I think that the majority of trainers will agree with me in saying that geldings not only stand fast work better than entires, but also recover more quickly from injuries of the fore leg.

Fish,(1) in his recent paper concerning the effect of castration upon the nutrition, growth, and power of resistance of goats, states that castration does not seem to reduce the gelding's "stamina or ability" to work. Perhaps it will be of interest to add here his assertion, based upon findings in experiments on one female and three male goats, that the resistance of the animal against disease is lowered by the operation. The following is one of the conclusions he arrived at in his study:

> The interstitial secretion represents an important element of growth factor. Its loss weakens, in time, the nutritive processes and ultimately the power of resistance so that when exposed to pathological and unsanitary conditions, animals suffering this loss are more likely to be affected.

MATERIALS AND METHODS

In the present study 48 litters with a total of 107 male guinea pigs, representing 59 castrates and 48 controls, were employed. Forty-four of these animals were from the same series used in the previous experiments.(7) Mention may be made here that both the test and the control animals were

from the same litter, and with the exception of litters 14, 15, and 20 in Group III, and litters 23, 25, and 27 in Group IV, which were castrated at the age of six months, all the test animals were operated upon at the age of six weeks. The technic of the operation and other matters pertaining to the care of the castrated and the control animals were fully discussed in my previous report.(7)

The method used in determining the pulling power of the animals operated upon and those not operated upon, in every litter, consisted of making each animal pull a load on a level cement floor. A simple slide box was used as the sledge with metric weights as the load; the weights were added gradually until the animal could no longer move the box with its utmost muscular exertion. The weight of the box plus the weights constituted the maximum pulling power of each animal. It may be mentioned here that it takes some time and considerable patience to start guinea pigs pulling a load; unless they are frightened and driven toward a corner or a dark place where another guinea pig is tied, they will not pull. In the beginning Chatillon's improved spring balance was tried in several cases, but its use was given up because the result obtained thereby was inaccurate, its lowest denomination being expressed in terms of only 100 grams. In every case the body weight was determined before the animal was subjected to the pulling operation.

To find out the power of endurance of castrated and non-castrated guinea pigs the length of time necessary to render each animal fatigued was determined. For this the very simple method of Strongman(6) in bringing about exhaustion in white mice was used. Both the castrated and the control animals in each litter were placed at the same time in water contained in an animal jar, 39 centimeters in height and 41.5 centimeters in diameter, and they were allowed to swim until they showed signs of fatigue. The water was deep enough so that the animals could not touch the bottom of the jar with the hind feet when in a perpendicular position. The animals were considered fatigued when they assumed a perpendicular position with just the tip of the nose emerging above the surface of the water, and remained more or less stationary in such position near one side of the jar.

In all cases both the castrated and the control animals were handled in a similar manner and under the same conditions.

It seems reasonable, therefore, to assume that the possible errors in the processes of determining the pulling power and endurance of each individual animal are insignificant and need not be considered in the interpretation of the results of the present experiments.

RESULTS OF EXPERIMENTS

To facilitate the presentation and discussion of the results of that part of the experiments concerning the effect of castration upon pulling power, the litters were divided, according to age, into eight groups. The records of both the test and the control animals in each group with reference to their body weight, pulling power, and difference between body weight and pulling power are given in Table 1. The percentage of excess that may be noted in the table represents how much heavier than the actual body weight is the maximum load that each animal can pull. It is computed by dividing the difference between the body weight and the maximum pulling power by the animal's body weight. The differences of the percentages of excess in favor of the castrated or noncastrated animals in each group are as follows:

Group I (*animals sixteen weeks old*).—Of the five castrated animals in this group only three show a higher percentage of excess than the corresponding controls; in litter 1 castrates 1 and 2 are, respectively, 3.82 and 9.76 higher, and in litter 2 the excess percentage is 18.14. The controls in litters 3 and 4 are 7.38 and 1.07 higher than their corresponding castrates.

Group II (*animals thirty weeks old*).—In this group four of the ten animals operated upon slightly surpass the corresponding controls in percentage of excess, the difference being 0.31 in litter 7; 12.6 in litter 9; 4.21 in litter 11; and 1.46 in litter 13. The differences of percentages of excess in favor of the controls are 0.53, 2.71, 9.05, 3.21, 8.21, and 8.73 in litters 5, 6, 8, 10, and 12.

Group III (*animals forty weeks old.*)—Only three of the eight castrated animals in this group show higher percentages of excess than do the controls. They exceed the controls by 3.99 in litter 16; 2.23 in litter 19; and 18.41 in litter 20. The controls, on the other hand, in litters 14, 15, 17, and 18 surpass their respective castrates by 11.74, 16.58, 0.38, 31.10, and 38.10.

Group IV (*animals forty-four weeks old*).—In this group five of the ten castrates show higher percentages of excess than do their controls, the differences being 4.14, 29.36, 0.52, 1.45, and 14.68 in litters 21, 22, 23, and 27. The other five castrates are surpassed by their controls by 10.38, 2.08, 12.71, 8.14, and 7.28 in litters 21, 24, 25, 26, and 27. It will be noted in Table 1 that in this group not all of the three castrated animals in litter 21 surpass the control in percentage of excess, for one is 10.38 lower than the control. Likewise, in litter 27, one of the two castrated animals is 7.28 lower than the control, and the other, 14.68 higher.

Group V (*animals forty-eight weeks old*).—Two of the six test animals here have in their favor 0.37 and 6.3 per cent more than their controls in litters 28 and 29, respectively. The other four test animals are 9.14, 30.75, 0.44, and 23.35 per cent below the controls in litters 29, 30, 31, and 32. In litter 29 one of the two castrates is 9.14 lower than its control and the other, 6.3 per cent higher.

Group VI (*animals fifty weeks old*).—In this group only one of the five castrated animals shows lower percentage of excess than the control, and that is in litter 34, where the castrate is surpassed by the control by 11.32. The remaining castrates are 33.34, 0.27, 37.66, and 14.5 higher than the corresponding controls in litters 33, 35, 36, and 37.

Group VII (*animals fifty-three weeks old*).—Of the seven test animals in this group five are 17.2, 32.78, 0.33, 3.85, and 30.68 per cent higher than the controls. The other two are 1.94 and 0.44 per cent lower than the controls in litters 38 and 41, respectively. In this group also the test animals in litters where there is more than one castrate do not show uniform results, the percentage of excess of one of the three castrates in litter 38 being surpassed by that of the control. The same is true in the case of litter 44, in which there are two castrates.

Group VIII (*animals fifty-seven weeks old*).—In this group the differences of percentages of excess in favor of the four castrates are 23.1, 17.26, 13.9, and 21.62 in litters 42, 45, 46, and 48, whereas those in favor of the controls are 7.93, 21.91, 3.01, and 10.95 in litters 42, 43, 44, and 47. In litter 42 one of the two castrates is lower than the control and the other is higher.

TABLE 1.—*Showing the actual body weight, the percentage of excess, and the maximum pulling power of the individual animals.*

GROUP I (ANIMALS SIXTEEN WEEKS OLD).

Litter No.	Animals.	Body weight.	Maximum pulling power.	Difference between body weight and pulling power.	Excess.
		gms.	*gms.*	*gms.*	*Per cent.*
1	Castrated	423	636	213	50.35
	do	421	658	237	56.29
	Control	447	655	208	46.53
2	Castrated	333	550	217	65.13
	Control	366	538	172	46.99
3	Castrated	390	605	215	55.12
	Control	400	650	250	62.50
4	Castrated	459	678	219	47.71
	Control	453	674	221	48.78
	GROUP II (ANIMALS THIRTY WEEKS OLD).				
5	Castrated	722	1,400	678	93.90
	Control	611	1,188	577	94.43
6	Castrated	788	1,414	626	79.44
	Control	695	1,266	571	82.15
7	Castrated	835	1,468	633	75.80
	Control	762	1,338	576	75.59
8	Castrated	759	1,238	479	63.10
	do	731	1,235	504	68.94
	Control	747	1,286	539	72.15
9	Castrated	737	1,107	370	50.20
	Control	694	958	264	38.04
10	Castrated	678	1,274	596	87.90
	Control	618	1,212	594	96.11
11	Castrated	672	1,310	638	94.94
	Control	712	1,358	646	90.73
12	Castrated	786	1,380	594	75.57
	Control	746	1,375	629	84.30
13	Castrated	860	1,530	670	77.90
	Control	815	1,438	623	76.44
	GROUP III (ANIMALS FORTY WEEKS OLD).				
14	Castrated	795	1,318	522	65.57
	do	787	1,265	478	60.73
	Control	798	1,415	617	77.31
15	Castrated	789	1,256	467	59.18
	Control	732	1,168	436	59.56
16	Castrated	712	1,268	556	78.09
	Control	726	1,264	538	74.10
17	Castrated	931	1,465	534	57.35
	Control	762	1,436	674	88.45
18	Castrated	882	1,388	506	57.36
	Control	683	1,335	652	95.46
19	Castrated	783	1,332	549	70.11
	Control	822	1,380	558	67.88
20	Castrated	746	1,357	611	81.90
	Control	871	1,424	553	63.49

TABLE 1.—*Showing the actual body weight, the percentage of excess, and the maximum pulling power of the individual animals*—Continued.

GROUP IV (ANIMALS FORTY-FOUR WEEKS OLD).

Litter No.	Animals.	Body weight.	Maximum pulling power.	Difference between body weight and pulling power.	Excess.
		gms.	*gms.*	*gms.*	*Per cent.*
21	Castrated	910	1,558	648	71.19
	do	726	1,426	700	96.41
	do	867	1,355	488	56.67
	Control	856	1,430	574	67.05
22	Castrated	798	1,408	610	76.44
	Control	810	1,425	615	75.92
23	Castrated	798	1,577	779	97.61
	Control	731	1,434	703	96.16
24	Castrated	783	1,386	603	77.01
	Control	775	1,388	613	79.09
25	Castrated	825	1,375	550	66.66
	Control	785	1,408	623	79.37
26	Castrated	899	1,544	645	71.74
	Control	860	1,547	687	79.88
27	Castrated	741	1,408	667	90.01
	do	795	1,336	541	68.05
	Control	746	1,308	562	75.33
	GROUP V (ANIMALS FORTY-EIGHT WEEKS OLD).				
28	Castrated	865	1,388	523	60.46
	Control	847	1,356	509	60.09
29	Castrated	781	1,452	671	85.91
	do	664	1,337	673	101.35
	Control	746	1,455	709	95.05
30	Castrated	873	1,240	367	42.03
	Control	757	1,308	551	72.78
31	Castrated	998	1,398	400	40.07
	Control	975	1,370	395	40.51
32	Castrated	882	1,456	583	66.09
	Control	739	1,400	661	89.44
	GROUP VI (ANIMALS FIFTY WEEKS OLD).				
33	Castrated	794	1,340	546	68.76
	Control	796	1,078	282	35.42
34	Castrated	862	1,534	672	77.95
	Control	774	1,465	691	39.27
35	Castrated	852	1,408	556	65.25
	Control	859	1,417	558	64.98
36	Castrated	751	1,366	615	81.89
	Control	893	1,288	395	44.23
37	Castrated	933	1,540	607	65.05
	Control	1,117	1,704	587	52.55

TABLE 1.—*Showing the actual body weight, the percentage of excess, and the maximum pulling power of the individual animals*—Continued.

GROUP VII (ANIMALS FIFTY-THREE WEEKS OLD).

Litter No.	Animals.	Body weight.	Maximum pulling power.	Difference between body weight and pulling power.	Excess.
		gms.	*gms.*	*gms.*	*Per cent.*
38	Castrated	944	1,718	774	81.99
	do	742	1,466	724	97.57
	do	875	1,425	550	62.85
	Control	889	1,465	576	64.79
39	Castrated	837	1,420	583	69.65
	Control	825	1,390	565	69.32
40	Castrated	788	1,518	730	92.63
	Control	776	1,465	689	88.78
41	Castrated	773	1,510	737	95.34
	do	833	1,368	535	64.22
	Control	781	1,286	505	64.66
	GROUP VIII (ANIMALS FIFTY-SEVEN WEEKS OLD).				
42	Castrated	796	1,468	672	84.42
	do	673	1,450	777	115.45
	Control	785	1,510	725	92.35
43	Castrated	885	1,424	539	60.90
	Control	803	1,468	665	82.81
44	Castrated	1,045	1,566	521	49.85
	Control	978	1,495	517	52.86
45	Castrated	838	1,365	527	62.88
	Control	868	1,264	396	45.62
46	Castrated	824	1,368	544	66.01
	Control	802	1,220	418	52.11
47	Castrated	888	1,560	672	75.67
	Control	785	1,465	680	86.62
48	Castrated	914	1,512	598	65.42
	Control	1,125	1,618	493	43.80

In the part of the work concerned with determining what influence castration has upon endurance, only 21 litters, representing 24 castrates and 21 controls, were used. The animals in the litters were from forty to fifty-seven weeks of age, and they were distributed as follows:

Group III, litters 14, 15, 16, and 17.
Group IV, litters 24, 25, and 26.
Group V, litter 32.
Group VI, litters 35 and 36.
Group VII, all the litters.
Group VIII, all the litters.

The data obtained in this part of the experiments are reported in Table 2. It will be noted in Table 2 that only 10

of the 24 castrated animals recorded slightly longer time than did their corresponding controls before they showed signs of fatigue. The length of time varied not only in the majority of the litters but also in both the castrated and the control animals. The variation ranged from ten to forty-four minutes in the castrates, and from thirteen to fifty minutes in the controls.

TABLE 2.—*Showing the length of time necessary to fatigue guinea pigs.*

Litter No.	Age in weeks.	Time in minutes.		Excess in favor of—	
		Castrate.	Control.	Castrate.	Control.
14	40	10	27		17
15	40	18	13	5	
16	40	33	35		2
17	40	29	18	11	
24	44	34	23	11	
25	44	44	18	26	
26	44	40	50		10
32	48	42	30	12	
35	50	15	15		
36	50	24	32		8
38	53	30	27	3	
		35	27	8	
		15	27		12
39	53	35	37		2
40	53	24	32		8
41	53	26			
		26	35		9
42	57	13	23		10
43	57	27	30		3
44	57	30	26	4	
45	57	26	29		3
46	57	30	25	5	
47	57	42	39	3	
48	57	29	22	7	

DISCUSSION OF RESULTS

Examination of the data given in Table 1, as well as the differences of percentages of excess reported under each group, shows that the present experiments have brought out some points which had not been worked out heretofore. To begin with, the load that guinea pigs—castrated or noncastrated—can pull is much heavier than their actual body weight. The percentage of excess varies considerably, not only in animals from different litters, but also in different individuals of the same litter. The evidence furnished by the present study seems to point to the conclusion that age has no apparent effect upon the relation between the pulling power and the animal's body weight.

As will be noted below, the percentages of the castrates that surpass the controls, or vice versa, in regard to the maximum pulling power in proportion to the body weight, are very far from being uniform in different litters.

	Per cent.
Group I:	
Castrates	60.00
Controls	50.00
Group II:	
Castrates	40.00
Controls	66.66
Group III:	
Castrates	37.50
Controls	71.42
Group IV:	
Castrates	50.00
Controls	71.42
Group V:	
Castrates	33.33
Controls	80.00
Group VI:	
Castrates	80.00
Controls	20.00
Group VII:	
Castrates	71.42
Controls	50.00
Group VIII:	
Castrates	50.00
Controls	57.14

When the difference between the highest and the lowest percentages of excess is taken to constitute the percentage variation, it will be noted that the percentage variations of both the castrated and the control animals do not agree in different groups, as will be observed in the following:

Group I:
Castrates, 65.13 minus 47.71 equals 17.42.
Controls, 62.50 minus 46.63 equals 15.97.
Group II:
Castrates, 94.94 minus 50.20 equals 44.74.
Controls, 96.11 minus 38.04 equals 58.07.
Group III:
Castrates, 81.90 minus 57.35 equals 24.55.
Controls, 95.46 minus 59.56 equals 35.90.
Group IV:
Castrates, 97.61 minus 56.67 equals 40.94.
Controls, 96.16 minus 67.05 equals 29.11.
Group V:
Castrates, 101.35 minus 40.07 equals 61.28.
Controls, 95.05 minus 40.51 equals 54.54.

Group VI:
Castrates, 81.89 minus 62.05 equals 16.84.
Controls, 89.27 minus 35.42 equals 53.85.
Group VII:
Castrates, 97.57 minus 62.85 equals 34.72.
Controls, 88.78 minus 64.66 equals 24.12.
Group VIII:
Castrates, 115.45 minus 49.85 equals 65.60.
Controls, 92.35 minus 43.80 equals 48.55.

The foregoing data seem to indicate that age has no bearing upon the percentage variation. When the extremes of the percentage variation in the castrated and the control animals in various groups are compared, it will be noted that the castrates and the controls practically coincide as far as variation is concerned, the ranges in the former being from 16.84 to 65.60 and in the latter, from 15.97 to 58.07 per cent.

By further referring to Table 1 it will be observed that even in litters having more than one test animal there are instances in which not all the castrates surpass the controls with respect to capacity of pulling load in proportion to body weight. In other words, not all the castrated animals belonging to the same litter can always exert equal force in pulling a load that is heavier than that which the control is able to pull under the same circumstances.

In Table 3 are given the averages of body weight, maximum pulling power, and percentages of excess of both the castrated and the control animals in different groups. When the general averages of the percentages of excess given in Table 3 are computed, they will be found to be 69.9 for the animals castrated and 68.08 for those that are entire. That is, on the average, the castrated animals can pull a load that is 69.9 per cent heavier than their body weight, and the controls, one that is 68.08 per cent heavier. It is evident, therefore, that there is a difference of 1.82 per cent in favor of the castrates. However, this difference, when the wide ranges of variation of percentages of excess in the noncastrated animals are taken into account, does not seem to indicate that it constitutes an after effect of the operation. As a matter of comparison, it may be worth while to mention here the capacity of the horse for work. According to Paton,(3) the force that a horse can exert on a steady pull on a level road is 75 per cent of its body weight; on a level road a total weight—vehicle plus load—of

two and one-half to four and one-half times the weight of the animal can be pulled at a walking pace.

TABLE 3.—*Showing the averages of body weight, maximum pulling power, and percentages of excess at different ages.*

Number of animals used.	Age.	Average body weight.	Average maximum pulling power.	Difference between body weight and pulling power.	Excess.
Group I:	*Weeks.*	*gms.*	*gms.*	*gms.*	*Per cent.*
Five castrates	16	405	625	220	54.32
Four controls		416	629	213	51.20
Group II:					
Ten castrates	30	756	1,335	579	76.58
Nine controls		711	1,268	557	78.34
Group III:					
Eight castrates	40	803	1,331	528	65.75
Seven controls		770	1,346	576	74.80
Group IV:					
Ten castrates	44	814	1,437	623	76.53
Seven controls		794	1,420	626	78.84
Group V:					
Six castrates	48	843	1,380	537	63.70
Five controls		810	1,377	567	70.00
Group VI:					
Five castrates	50	838	1,437	599	71.47
Five controls		887	1,390	503	56.70
Group VII:					
Seven castrates	53	827	1,489	662	80.04
Four controls		817	1,401	584	71.48
Group VIII:					
Eight castrates	57	857	1,464	607	70.82
Seven controls		878	1,434	556	63.32

Computing from the data given in Table 2, it will be found that the average length of time necessary to fatigue the animals is, in round numbers, twenty-eight minutes in the castrates and twenty-seven in the controls; that is, a difference of one minute in favor of the castrates. Taking into account the wide ranges of variation in the number of minutes both in the castrates and in the controls and the fact that the ranges almost coincide, being from ten to forty-four minutes in the castrates and from thirteen to fifty minutes in the controls, it seems quite reasonable to conclude that castration does not alter the power of endurance in guinea pigs. The results obtained in this part of the work are quite contrary to expectation; because, in spite of being quiet and steady (not jumping much) in swimming, the castrated animals, on the average, show signs of fatigue after the same length of time as do the controls.

CONCLUSIONS

From the evidence brought out by the experiments, the following conclusions can be drawn:

1. The maximum load that guinea pigs can pull on a level surface is much heavier than the body weight; it seems that age does not influence the relation between the pulling power and the body weight of the animal.

2. On the average, the load that the guinea pig can pull is, discarding fractions, 68 per cent heavier than the animal's body weight.

3. The capacity for pulling load is not modified by castration in guinea pigs, either before or after the age of puberty.

4. In as much as in castrated animals the percentages of excess, in the majority of the cases, fall within the extremes of variation of those of the controls, the very high or very low percentages of pulling power in proportion to body weight that may be observed in certain litters are not considered incident to the operation; but they may be attributed to some other factors peculiar to the individual animal.

5. In spite of the feminine attitude and temperament developed as a consequence of castration, the endurance in castrated guinea pigs, at least in swimming, apparently remains unaltered after the operation.

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THE FLORA OF BANGUEY ISLAND

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ONE TEXT FIGURE

Banguey and Balambangan Islands are situated a few miles north of Inarutang Point at the extreme northeastern corner of Borneo off the entrance to Marudu Bay. The strait separating Banguey from Borneo proper is shallow, with a maximum depth of from 25 to 40 meters, and is about 11 kilometers in width. Balabac Strait, separating these islands from Balabac, the most western part of the Philippines, is about 50 kilometers wide and has a maximum depth of 64 fathoms.

I have found no records of any botanical material having been collected on Banguey previous to 1922, when Mr. D. D. Wood, conservator of forests, British North Borneo, prepared a small collection containing representatives of twenty-six species. This collection has been enumerated by me.[1] Through Mr. Wood's interest very much more extensive collections have become available to me for study, these having been made by Messrs. P. Castro and F. Melegrito, two Filipino rangers in the employ of the British North Borneo Forestry Department. A preliminary examination of this material indicated that it was of more than passing interest and accordingly the following enumeration has been prepared.

Banguey, or Banggi, Island comprises an area of approximately 98,700 acres; the topography in general is irregular, with numerous hills and ranges and separating narrow valleys. The highest elevation is about 570 meters so that, as far as the vegetation is concerned, we have to deal only with a lowland flora, elements characteristic of Malaysian mountains with altitudes of 700 to 800 meters and above being entirely absent.

Head ranger Jose Agama, of the British North Borneo Forestry Department, examined the island in 1922 and reported about 58 per cent of the land area to be covered with virgin forest; 25 per cent, with noncommercial forest; 15 per cent,

[1] Philip. Journ. Sci. 24 (1924) 113–116.

FIG. 1. Banguey and Balambangan Islands.

with mangrove swamp; and 2 per cent, with brush land and cultivated land, the cultivated areas comprising less than 0.02 per cent of the total area of the island. From Mr. Agama's report it is manifest that the delimitation of the commercial and noncommercial forests and brush lands, here as elsewhere in Malaysia, is largely due to the primitive agriculture practiced by the sparse population, which consists of Dusuns, with a few Bajaus along the coast. These primitive people practice a very crude type of agriculture; they clear the land, burn the débris, plant crops for a season or two, and then abandon the clearing and prepare a new one—a type of agriculture widely practiced in the Malay Archipelago and one that is very destructive to the forest resources.

Together with the Banguey collection the few specimens collected by Messrs. Castro and Melegrito on the neighboring island Balambangan are enumerated. This island is only about one-third as large as Banguey and is separated from the latter by a strait about 5 kilometers wide. It differs from Banguey in having in its eastern half considerable areas of open grassland; this fact probably indicates a somewhat drier climate than exists in Banguey, or at least a more strongly pronounced dry season in the eastern part of the island. On these islands the rainfall, judged by the neighboring Kudat records, averages somewhat over 80 inches per annum and is rather evenly distributed through the year, although rains are more frequent in November to February, the period of the northeastern monsoon, than at other times.

Balambangan is of historical interest because here was established the first British settlement in Borneo. The British East India Company's flag was formally planted in Balambangan in 1763, the year that Manila was captured by the British. Ten years later a settlement was definitely established, only to be utterly destroyed by the Joloano Moros in 1775 with great loss to the company. The settlement was reëstablished in 1803 but, as it was expensive to maintain it and there was little prospect of its being of immediate advantage to the company, it was abandoned the following year.[2]

The vegetation of these islands is not essentially different from that of contiguous parts of Borneo and neighboring parts

[2] Rutter, O., British North Borneo. An account of its history, resources and native tribes (1922) 93–95.

of the Philippines. Although twenty species are described as new in this paper, it is highly improbable that all of them are actually confined to the island. Most of them will doubtless be found in neighboring parts of Borneo proper, as botanical exploration progresses, and some will probably be found in those parts of the Philippines nearest Banguey; namely, Balabac, Bugsuk, and southern Palawan.

About four hundred ten species are represented in the material available for study and of the four hundred seventy-five individual numbers I have succeeded in identifying, at least to the genus, all but two specimens, one of which is sterile and the other in fruit only. It is doubtful if the number of species indicated above now definitely known from Banguey represents more than one-third or perhaps one-fourth of those that actually occur there, for the material on which this paper is based was collected incidental to other work and no claim is made for completeness. Mr. Agama in his forest reconnaissance and land classification report on Banguey Island records such genera of trees as *Pterospermum, Octomeles, Dialum, Shorea, Koompassia, Pterocarpus, Toona, Palaquium, Vatica, Planchonia, Koordersiodendron,* and *Artocarpus,* genera that are not represented in the actual botanical collections so far made on the island.

In reference to floristic relationships we can eliminate from consideration about sixty species which represent weeds and various cultivated forms, as these are all introduced species; the strand plants should also be eliminated from consideration. The real relationships of the Banguey flora, as is the case with that of other islands in Malaysia, should be estimated from the indigenous species, chiefly those occurring in the primary forest.

About seventy species are represented which were previously known only from the Philippines, including the following:

Areca mammillata Becc.
Orania paraguanensis Becc.
Pycnarrhena elliptica Diels.
Mitrephora williamsii C. B. Rob.
Connarus stellatus Merr.
Atalantia disticha Merr.
Chisocheton pentandrus Merr.
Aglaia cumingiana Turcz.
Drypetes littoralis Merr.
Tetrastigma loheri Gagnep.
Columella pterita Merr.
Leea negrosensis Elm.
Elaeocarpus cumingii Turcz.
Rinorea glandulosa Merr.
Casearia polyantha Merr.
Embelia philippinensis A. DC.
Diospyros fasciculiflora Merr.
Psychotria membranifolia Bartl.
Vernonia pyrrhopappa Schulz-Bip.

Some of these species were previously known only from those parts of the Philippines geographically nearest to Borneo, such as Balabac, Palawan, the Sulu Archipelago, and eastern Mindanao, but many are of wide Philippine distribution.

About sixty species previously known to occur in Borneo proper, but which are not known to occur in the Philippines, are represented, such as the following:

Lepironia mucronata L. C. Rich.
Calamus javensis Blume.
Pandanus basilocularis Martelli.
Bromheadia finlaysoniana Reichb., f.
Coscinum sp.
Whitfordiodendron nieuwenhuisii Merr.
Chaetocarpus castanocarpus Thw.
Wormia subsessilis Miq.
Euthemis leucocarpa Jack.
Ryparosa oligophlebia Merr.
Rhodamnia cinerea Jack.
Maba punctata Hiern.
Fagraea spicata Baker.
Uncaria ferrea DC.
Timonius flavescens Baker.
Gaertnera vaginans Merr.
Melothria affinis King.

It is noteworthy that no representatives of the genera *Lepironia, Bromheadia, Prainea, Coscinum, Chaetocarpus, Euthemis, Rhodamnia,* and *Gaertnera* are known from the Philippines.

Two genera, *Soulamea* and *Paranephelium,* are not known from either Borneo proper or the Philippines, the former being an eastern Malaysian genus and the latter a western Malaysian one. Species in other genera known from neither Borneo proper nor the Philippines are *Crataeva macrocarpa* Kurz and *Homalium foetidum* Benth.

A detailed study of the Banguey flora shows it to be remarkably intermediate between that of the Philippines and that of Borneo. The list of species that occur there and that were previously known only from the Philippines is surprisingly long; and, while the list of those previously known from Borneo is somewhat shorter, it is more impressive on account of the fact that no less than eight genera are represented which, so far as is known at present, do not occur in the Philippines. As would be expected from the geographic position of the island, the Banguey flora shows definite affinities with both Borneo and the Philippines. However, the fact must not be overlooked that the entire region has been very inadequately explored, and many of the Banguey species are certain to occur in Borneo proper, and many may be expected to occur in Balabac and in southern Palawan. It is well known that Balabac, Palawan,

and the Calamian group in the Philippines lie on the same continental shelf that carries Sumatra, Java, and Borneo, and that during Pleistocene times these islands were connected with Borneo. As would be expected from this geologic history, they are biologically more a part of Borneo than of the Philippines proper.

Twenty-one species are described as new in this paper, and undoubtedly a few undescribed forms are represented among those which I have referred merely to their genera because of lack of complete material; one of the latter may well represent an undescribed genus. The new species are as follows:

Scindapsus longistipitatus.
Forrestia laxiflora.
Pleomele bangueyensis.
Tacca angustilobata.
Castanopsis woodii.
Prainea multinervia.
Macaranga pearsonii.
Galearia dolichobotrys.
Codiaeum affine.
Durio acuminatissimus.
Sterculia pearsonii.
Sterculia castroi.
Saurauia melegritoi.
Dipterocarpus caudiferus.
Dipterocarpus wpodii.
Taraktogenos anomala.
Hydnocarpus yatesii.
Begonia subnummularifolia.
Kopsia parvifolia.
Ixora tenelliflora.
Psychotria bangueyensis.

For all practical purposes Banguey Island is a part of Borneo. Assuming that it is a part of Borneo, the present study adds (including the forms herein described as new) approximately one hundred species to the list of those definitely recorded from Borneo.

In preparing this enumeration I have not given citations to the original place of publication of the individual species except in the cases where the species have not previously been recorded from Borneo. I have, for each species previously known from either the Philippines or Borneo, or both, added references to my two large publications on Borneo and the Philippines.[3] In those publications literature references, synonyms, geographic distribution, etc., are given for each species.

The original set of specimens on which this paper is based is deposited in the Herbarium of the University of California. Fairly complete duplicate sets have been sent to the Forestry

[3] A bibliographic enumeration of Bornean plants, Journ. Straits Branch Roy. As. Soc. Special Number (1921) 1–637. An enumeration of Philippine flowering plants, Bur. Sci. Publ. 18: 1 (1922–25) VII, 1–463; 2 (1923) 1–530; 3 (1923) 1–628; 4, in press.

Department, Sandakan, British North Borneo, and to the Bureau of Science in Manila, and the remaining material will be sent to the larger herbaria in Europe, Asia, and the United States.

PTERIDOPHYTA

POLYPODIACEÆ

Genus **NEPHROLEPIS** Schott

Nephrolepis hirsutula (Forst.) Presl.

Nephrolepis hirsutula (Forst.) Presl, Tent. Pterid. (1836) 79.

No. 1575, without data. Pantropic.

SCHIZAEACEÆ

Genus **LYGODIUM** Swartz

Lygodium circinnatum (Burm.) Sw.

Lygodium circinnatum (Burm.) Sw., Syn. (1806) 153.

No. 1578, without data. Tropical Asia through Malaysia to tropical Australia.

Genus **SCHIZAEA** Smith

Schizaea dichotoma (Linn.) Sm.

Schizaea dichotoma (Linn.) Sm., in Mém. Acad. Turin 5 (1793) 422.

No. 1775, from Balambangan Island, in forests; local name, *sabintid.* Tropical Asia to Madagascar, through Malaysia to tropical Australia and Polynesia.

OPHIOGLOSSACEÆ

Genus **HELMINTHOSTACHYS** Kaulfuss

Helminthostachys zeylanica (Linn.) Hook.

Helminthostachys zeylanica (Linn.) Hook., Gen. Fil. (1840) *t. 47.*

No. 1614, in forests at low altitudes. Tropical Asia through Malaysia to tropical Australia and New Caledonia.

LYCOPODIACEÆ

Genus **LYCOPODIUM** Linnæus

Lycopodium cernuum Linn.

Lycopodium cernum Linn., Sp. Pl. (1753) 1103.

Nos. 1461, 1769, the latter from Balambangan Island, in swampy places and on open slopes. Pantropic.

ANGIOSPERMÆ

MONOCOTYLEDONEÆ

PANDANACEÆ

Genus **PANDANUS** Rumphius

Pandanus tectorius Sol.

Pandanus tectorius Sol.; MERR., Enum. Born. Pl.[4] (1921) 36; Enum. Philip. Fl. Pl. 1 (1922) 21.

No. 1695, along the seashore. A typical strand plant of the Old World Tropics, extending from India to southern China southward and eastward to tropical Australia and Polynesia.

Pandanus basilocularis Martelli.

Pandanus basilocularis Martelli; MERR., Enum. Born. Pl. (1921) 35.

No. 1484, along the seashore. Known only from Borneo.

GRAMINEÆ

Genus **COIX** Linnæus

Coix lachryma-jobi Linn.

Coix lachryma-jobi Linn.; MERR., Enum. Born. Pl. (1921) 38; Enum. Philip. Fl. Pl. 1 (1922) 29.

No. 1645, near the seashore and cultivated. A native of the Old World, now pantropic.

Genus **ANDROPOGON** Linnæus

Andropogon sorghum (Linn.) Brot.

Andropogon sorghum (Linn.) Brot.; MERR., Enum. Philip. Fl. Pl. 1 (1922) 48.

No. 1647, cultivated. Not recorded from Borneo proper but certainly occurring there. All warm countries, in cultivation.

Genus **ISCHAEMUM** Linnæus

Ischaemum aristatum Linn.

Ischaemum aristatum Linn.; MERR., Enum. Philip. Fl. Pl. 1 (1922) 37.

No. 1505, in open places at low altitudes. India to southern China and Malaysia.

[4] This abbreviated form is used for convenience. The full title is: "A bibliographic enumeration of Bornean plants," published in Journ. Roy. As. Soc. Straits Branch Special Number (1921) 1–637.

Genus **PANICUM** Linnæus

Panicum malabaricum (Linn.) Merr.

Panicum malabaricum (Linn.) MERR., Enum. Born. Pl. (1921) 46; Enum. Philip. Fl. Pl. 1 (1922) 65.

No. 1485, in open places. India to Malaysia.

Panicum nodosum Kunth.

Panicum nodosum Kunth; MERR., Enum. Born. Pl. (1921) 46; Enum. Philip. Fl. Pl. 1 (1922) 65.

No. 1330, in open places. India to southern China and Malaysia.

Panicum pilipes Nees & Arn.

Panicum pilipes Nees & Arn.; MERR., Enum. Born. Pl. (1921) 46; Enum. Philip. Fl. Pl. 1 (1922) 66.

No. 1697, in open places. Tropical Asia to Australia and Polynesia.

Genus **SETARIA** Beauvois

Setaria italica (Linn.) Beauv.

Setaria italica (Linn.) Beauv.; MERR., Enum. Born. Pl. (1921) 48; Enum. Philip. Fl. Pl. 1 (1922) 73.

No. 1646, cultivated, as it is in all warm countries. Italian millet.

Genus **OPLISMENUS** Beauvois

Oplismenus compositus (Linn.) Beauv.

Oplismenus compositus (Linn.) Beauv.; MERR., Enum. Born. Pl. (1921) 47; Enum. Philip. Fl. Pl. 1 (1922) 71.

No. 1486, in open places. Pantropic.

Genus **ORYZA** Linnæus

Oryza meyeriana (Zoll. & Mor.) Benth.

Oryza meyeriana (Zoll. & Mor.) Benth.; MERR., Enum. Born. Pl. (1921) 49; Enum. Philip. Fl. Pl. 1 (1922) 77.

No. 1397, in open forests. India to Celebes and the Philippines.

Genus **CENTOTHECA** Desvaux

Centotheca latifolia (Linn.) Trin.

Centotheca latifolia (Linn.) Trin.; MERR., Enum. Born. Pl. (1921) 51; Enum. Philip. Fl. Pl. 1 (1922) 91.

Nos. 1329, 1576, in open forests. Old World Tropics, extending from Africa and Polynesia.

CYPERACEÆ

Genus **HYPOLYTRUM** Richard

Hypolytrum compactum Nees.

Hypolytrum compactum Nees; MERR., Enum. Born. Pl. (1921) 53; Enum. Philip. Fl. Pl. 1 (1922) 102.

No. 1654, in open places. Indo-China, Andaman Islands, Borneo, and the Philippines.

Hypolytrum latifolium L. C. Rich.

Hypolytrum latifolium L. C. Rich.; MERR., Enum. Born. Pl. (1921) 54; Enum. Philip. Fl. Pl. 1 (1922) 103.

No. 1780, from Balambangan Island, with the local name *brawbi.* India to Formosa through Malaysia to Polynesia.

Genus **CYPERUS** Linnæus

Cyperus distans Linn. f.

Cyperus distans Linn. f.; MERR., Enum. Born. Pl. (1921) 54; Enum. Philip. Fl. Pl. 1 (1922) 105.

No. 1710, in cultivated land. Pantropic.

Cyperus pubisquamus Steud.

Cyperus pubisquamus Steud., MERR. Enum. Born. Pl. (1921) 55.

No. 1696, near the seashore. India to Malaysia and the Philippines; placed by Suringar as a variety (*macrostachyus* Boeck.) of *Cyperus diffusus* Vahl, and closely allied to the latter.

Genus **MARISCUS** Gaertner

Mariscus cyperinus (Retz.) Vahl.

Mariscus cyperinus (Retz.) Vahl; MERR., Enum. Born. Pl. (1921) 56; Enum. Philip. Fl. Pl. 1 (1922) 112.

No. 1629, near the seashore. India to Malaysia and Polynesia.

Mariscus sieberianus Nees.

Mariscus sieberianus Nees; MERR., Enum. Born. Pl. (1921) 57; Enum. Philip. Fl. Pl. 1 (1922) 114.

No. 1588, in open forests. Pantropic.

Mariscus pennatus (Lam.) Merr.

Mariscus pennatus (Lam.) MERR., Enum. Philip. Fl. Pl. 1 (1922) 113 (*Mariscus albescens* Gaudich.)
M. stuppeus, MERR., Enum. Born. Pl. (1921) 57.

No. 1663, along the seashore. Tropical Africa to eastern Polynesia, within the influence of salt or brackish water.

Genus **KYLLINGA** Rottboell

Kyllinga brevifolia Rottb.

Kyllinga brevifolia Rottb.; MERR., Enum. Born. Pl. (1921) 58; Enum. Philip. Fl. Pl. 1 (1922) 114.

No. 1690, in open places. Pantropic.

Genus **FIMBRISTYLIS** Vahl

Fimbristylis annua (All.) R. & S.

Fimbristylis annua (All.) R. & S.; MERR., Enum. Born. Pl. (1921) 60; Enum. Philip. Fl. Pl. 1 (1922) 121.

No. 1586, in open places. Pantropic.

Genus **SCHOENUS** Linnæus

Schoenus falcatus R. Br.

Schoenus falcatus R. Br.; MERR., Enum. Philip. Fl. Pl. 1 (1922) 128.

No. 1762, from Balambangan Island, in damp places. Formosa, Luzon, Borneo, and northern Australia.

Genus **MAPANIA** Aublet

Mapania humilis (Hassk.) F.-Vill.

Mapania humilis (Hassk.) F.-Vill.; MERR., Enum. Born. Pl. (1921 64; Enum. Philip. Fl. Pl. 1 (1922) 132.

No. 1758, in forests. Malay Peninsula and Archipelago.

Genus **LEPIRONIA** Richard

Lepironia mucronata L. C. Rich.

Lepironia mucronata L. C. Rich.; MERR., Enum. Born. Pl. (1921) 64.

No. 1740, from Balambangan Island, in a fresh-water swamp. Ceylon to southern China and Madagascar, through Malaysia to Australia, but no representative of the genus as yet recorded from the Philippines.

Genus **SCLERIA** Bergius

Scleria multifoliata Boeck.

Scleria multifoliata Boeck.; MERR., Enum. Born. Pl. (1921) 66.

No. 1347, in open forests. India to Malaysia, but not certainly known from the Philippines.

PALMÆ

Genus **ARECA** Linnæus

Areca mammillata Becc.

Areca mammillata Becc. in Philip. Journ. Sci. 2 (1907) Bot. 601; Merr., Enum. Philip. Fl. Pl. 1 (1922) 169 (*A. vidaliana* Becc.).

No. 1327, without notes. The specimen is quite the same as the Palawan form; the species hitherto was known only from the latter island.

Genus **CARYOTA** Linnæus

Caryota mitis Lour.

Caryota mitis Lour.; Merr., Enum. Born. Pl. (1921) 82; Enum. Philip. Fl. Pl. 1 (1922) 159.

No. 1599, in forests. Burma and Indo-China to Sumatra, Java, and Palawan.

Genus **ORANIA** Zippel

Orania paraguanensis Becc.

Orania paraguanensis Becc. in Webbia 1 (1905) 335; Merr., Enum. Philip. Fl. Pl. 1 (1922) 161.

No. 1495, near the seashore. The specimen has only very small, wholly immature fruits, but I cannot distinguish it from this species which was hitherto known only from Palawan.

Genus **LICUALA** Wurmb

Licuala spinosa Wurmb.

Licuala spinosa Wurmb; Merr., Enum. Born. Pl. (1921) 70; Enum. Philip. Fl. Pl. 1 (1922) 143.

No. 1388, in open forests. A genus with over twenty species in Borneo, but represented in the Philippines by only this one which there occurs only in Balabac, Palawan, and Culion. Indo-China to the Moluccas.

Genus **CALAMUS** Linnæus

Calamus javensis Blume var. **woodii** Merr.

Calamus javensis Blume var. *woodii* Merr. in Philip. Journ. Sci. 24 (1924) 113.

No. 1111, in forests. The variety endemic, the species in the Malay Peninsula, Sumatra, and Java, but not known from the Philippines.

Calamus sp.

No. 1569, in mangrove swamps, the specimen fragmentary, with very immature fruits, probably representing an undescribed species.

ARACEÆ

Genus **AMORPHOPHALLUS** Blume

Amorphophallus rivieri Durieu var. **konjac** Engl.

Amorphophallus rivieri Durieu var. *konjac* Engl.; MERR., Enum. Philip. Fl. Pl. 1 (1922) 180.

No. 1127, in damp alluvial soil. Japan to Indo-China and the Philippines, but not recorded from Borneo proper.

Genus **HOMALOMENA** Schott

Homalomena sagittifolia Jungh.

Homalomena sagittifolia Jungh.; MERR., Enum. Born. Pl. (1921) 96.

No. 1410, in forests. Malay Peninsula and Borneo.

Genus **SCHISMATOGLOTTIS** Zollinger and Moritzi

Schismatoglottis calyptrata (Roxb.) Z. & M.

Schismatoglottis calyptrata (Roxb.) Z & M.; MERR., Enum. Born. Pl. (1921) 98; Enum. Philip. Fl. Pl. 1 (1922) 181.

No. 1343, in primary forests at low altitudes. Burma through Malaysia to New Guinea.

Genus **RHAPHIDOPHORA** Hasskarl

Rhaphidophora sp.

No. 1455, a sterile specimen from forested slopes, possibly referable to *Epipremnum.*

Genus **SCINDAPSUS** Schott

Scindapsus longistipitatus sp. nov.

Caudex circiter 1 cm crassus; foliis chartaceis, oblongis ad elliptico-oblongis, leviter inaequilateralibus, 29 ad 33 cm longis, 5.5 ad 13 cm latis, utrinque subaequaliter angustatis, apice breviter acuminatis, basi obtusis, circiter 1 cm latis, distincte inaequilateralibus; nervis primariis circiter 15 utrinque, tenuibus, adscendentibus, quam secondariis vix magis distinctioribus; petiolo 12 ad 17 cm longo, sub apice subgeniculato, usque ad geniculo vaginato, majoribus inferne ad 1.8 cm lato; inflorescentiis breviter pedunculatis, spathis persistentibus, 14 ad 17 cm longis, 3 ad 3.5 cm latis, coriaceis, breviter acumi-

natis; spadicis sub fructu longissime (18 ad 20 cm) stipitatis, cylindraceis, obtusis, 8 ad 10 cm longis, circiter 1.5 cm diametro; baccis circiter 5 mm longis, apice truncatis, rhomboideis. stigmate immerso.

BANGUEY ISLAND, *1345 P. Castro and F. Melegrito,* in primary forests, altitude about 20 meters.

A species very strongly characterized among all the described forms of this genus by its very long-stipitate spadices, these in fruit being 18 to 29 cm in length, the flattened spathes persistent.

FLAGELLARIACEÆ

Genus **FLAGELLARIA** Linnæus

Flagellaria indica Linn.

Flagellaria indica Linn; MERR., Enum. Born. Pl. (1921) 109; Enum. Philip. Fl. Pl. 1 (1922) 191.

No. 1582, in open forests. Tropical Africa and Asia through Malaysia to tropical Australia and the Marianne Islands.

ERIOCAULONACEÆ

Genus **ERIOCAULON** Linnæus

Eriocaulon longifolium Nees.

Eriocaulon longifolium Nees; MERR., Enum. Born. Pl. (1921) 110.

No. 1725, from Balambangan Island, in marshy places. Southeastern China to Ceylon, Malaysia, and Madagascar, but not recorded from the Philippines.

COMMELINACEÆ

Genus **ANEILEMA** R. Brown

Aneilema scaberrimum (Blume) Kunth.

Aneilema scaberrimum (Blume) Kunth; MERR., Enum. Born. Pl. (1921) 113.

No. 1387, in primary forests. India to Sumatra, Java, and Borneo; not recorded from the Philippines, although some of the Philippine material determined as *A. vitiense* Seem. may belong here.

Genus **FORRESTIA** A. Richard

Forrestia laxiflora sp. nov.

Caulis prostratis, radicantibus, glabris vel partibus junioribus leviter pubescentibus, in siccitate profunde sulcatis, cir-

citer 4 mm diametro, apice adscendentibus vel suberectis; foliis membranaceis, oblongo-ellipticis, 15 ad 25 cm longis, 6 ad 7 cm latis, tenuiter acuminatis, basi decurrentibus, distincte petiolatis, supra glabris, subtus glabris vel parcissime pubescentibus; petiolo ad margine ciliato-piloso, vaginis obliquis, plus minusve ciliato-pilosis, circiter 2 cm longis, inflatis; inflorescentiis caulinis, distincte pedunculatis, circiter 5 cm longis, cymosis, laxis, leviter ciliatis; perianthi segmentis (sub fructu) linearioblongis, glabris, circiter 12 mm longis, 2 mm altis; fructibus glabris vel subglabris, subellipsoideis, circiter 8 mm longis; seminibus solitariis.

BANGUEY ISLAND, *1618 P. Castro and F. Melegrito,* August, 1923, in forests, altitude about 30 meters, flowers "blue" (that is, probably purple).

A species well characterized in this small genus by its lax, distinctly peduncled inflorescences, the flowers somewhat crowded in small heads on the branches of the inflorescence, not forming a dense capitate inflorescence as in the other species. The bracts are somewhat pubescent, oblong-ovate, somewhat acuminate, about 1 cm long.

LILIACEÆ

Genus **DIANELLA** Lamarck

Dianella ensifolia (Linn.) DC.

Dianella ensifolia (Linn.) DC.; MERR., Enum. Born. Pl. (1921) 114; Enum. Philip. Fl. Pl. 1 (1922) 203.

Nos. 1744, 1745, the latter from Balambangan Island, near swamps at low altitudes. India to the Mascarene Islands, Formosa, Malaysia, tropical Australia, and Polynesia.

Genus **PLEOMELE** Salisbury

Pleomele borneensis Merr.

Pleomele borneensis MERR. in Journ. Straits Branch Roy. As. Soc. 85 (1922) 160.

No. 1476, near the seashore. British North Borneo.

Pleomele bangueyensis sp. nov.

Frutex circiter 2 m altus, glaber, ramulis 5 mm diametro; foliis chartaceis, viridis, oblongis ad oblongo-oblanceolatis, 20 ad 30 cm longis, 5 ad 7 cm latis, acute acuminatis, deorsum angustatis, longe decurrentibus, petiolo 2.5 ad 7 cm longo; inflorescentiis paniculatis, erectis, circiter 50 cm longis, pedunculo basi bracteis paucis lanceolatis perspicue acuminatis 2.5 ad 5

cm longis instructis, ramis paucis (circiter 8), curvato-adscendentibus vel subpatulis, 12 ad 20 cm longis; floribus albidis, 1.2 ad 1.5 cm longis, binis vel trinis vel superioribus solitariis, in ramis primariis racemose dispositis, breviter (2 mm) pedicellatis, perianthi segmentis anguste oblanceolatis, circiter 1.2 mm latis, bracteis late ovatis, 2 mm longis.

BANGUEY ISLAND, *1443 P. Castro and F. Melegrito*, August, 1923, in forests, altitude about 30 meters. A juvenile form is represented by *1405*, from the same locality.

A species belonging in the group with *Pleomele aurantiaca* N. E. Br., of the Malay Peninsula and Borneo, but with smaller leaves which are uniformly green, not mottled, and much smaller flowers. The leaves are transversely reticulate between the longitudinal nerves, the transverse veinlets being distant and usually oblique.

Genus SMILAX Linnæus

Smilax leucophylla Blume.

Smilax leucophylla Blume; MERR., Enum. Born. Pl. (1921) 116; Enum. Philip. Fl. Pl. 1 (1922) 208.

No. 1591, in open forests. Malay Peninsula to Java, the Philippines, the Moluccas, and New Guinea.

Smilax sp.

No. 1776, from Balambangan Island, a sterile specimen, in vegetative characters approximating *Smilax modesta* A. DC. of Java, and possibly representing that species.

TACCACEÆ

Genus TACCA Forster

Tacca pinnatifida Forster.

Tacca pinnatifida Forster; MERR., Enum. Philip. Pl. 1 (1922) 215.

No. 1473, near the seashore. Old World Tropics generally, from Africa to eastern Polynesia. Not recorded from Borneo proper, but certainly occurring there.

Tacca angustilobata sp. nov.

Foliis longe petiolatis, membranaceis, olivaceis, glabris, 17 ad 26 cm longis, 25 ad 35 cm latis, profunde palmatim 7- ad 11-lobatis, lobis anguste lanceolatis, tenuiter acuminatis, 13 ad 22 cm longis, 1 ad 2.5 cm latis, basi truncatis vel subtruncatis, pedatim 7- ad 11-nervis; petiolo tenue, 15 ad 50 cm longo; pedunculo usque ad 65 cm longo, glabro, tenue, longitudinaliter

sulcato; bracteis membranaceis vel subchartaceis, olivaceis, exterioribus binis sessilibus, rhomboideo-ovatis, acute acuminatis, basi late acutis vel subrotundatis, circiter 9-nerviis, 6 cm longis, 4 cm latis, binis interioribus stipitatis, interioribus simillimis, stipite circiter 2 cm longo; floribus ignotis; fructibus circiter 14, subglobosis vel ovoideis, 8 mm diametro, rubris, pedicellis tenuibus, 1.5 ad 2 cm longis.

BANGUEY ISLAND, *1398 P. Castro and F. Melegrito*, August, 1923, in primary forests at low altitudes.

A species belonging in the group with *Tacca palmata* Blume, strongly characterized by its numerously and very narrowly lobed leaves, the lobes extending to within 3 to 6 cm of the base of the leaf, the corresponding sinuses being narrow and generally acute. While the leaves are strictly palmately lobed, the lobes of each leaf being subequal in size, the leaf base is conspicuously pedately nerved, the midrib of the central two or three lobes leaving the apex of the petiole, those of the other lobes leaving the two lateral, basal, marginal nerves 1 to 2 cm from the apex of the petiole. The present species is doubtless most closely allied to the very imperfectly described *Tacca palmatifida* Baker of Celebes which, however, has from 13 to 17 lobes, which are united for the lower one-fourth to one-third, the fruits exceeding 2 cm in length.

MUSACEÆ

Genus **MUSA** Linnæus

Musa sapientum Linn.

Musa sapientum Linn.; MERR., Enum. Born. Pl. (1921) 119; Enum. Philip. Fl. Pl. 1 (1922) 222.

No. 1469, in open places; a variety or form of the common banana, pantropic in cultivation.

ZINGIBERACEÆ

Genus **GLOBBA** Linnæus

Globba sp.

No. 1711, in forests at low altitudes, flowers yellow. The material is so imperfect that it cannot be properly identified.

Genus **ZINGIBER** Adanson

Zingiber zerumbet (Linn.) Sm.

Zingiber zerumbet (Linn.) Sm.; MERR., Enum. Born. Pl. (1921) 124; Enum. Philip. Fl. Pl. 1 (1922) 229.

No. 1479, near the seashore. The specimen seems to represent a depauperate, narrow-leaved form of this pantropic species.

Zingiber sp.

No. 1606, in forests. An imperfect specimen, no flowers, resembling the Philippine *Zingiber sylvatica* Elm.

Genus **LANGUAS** Koenig

Languas haenkei (Presl) Merr.

Languas haenkei (Presl) MERR., Enum. Philip. Fl. Pl. 1 (1922) 232.

No. 1531, in forests. The specimen is in fruit and additional material may show it to be distinct from the Philippine species to which I have here referred it, and which is otherwise known only from the Philippines.

Genus **COSTUS** Linnæus

Costus hirsutus Blume.

Costus hirsutus Blume; MERR., Enum. Philip. Fl. Pl. 1 (1924) 246 [*Costus speciosus* Sm. var. *hirsutus* K. Schum.; MERR., Enum. Born. Pl. (1921) 131].

Nos. 1108, 1349, in open forests. India to Formosa through Malaysia to New Guinea.

CANNACEÆ

Genus **CANNA** Linnæus

Canna indica Linn.

Canna indica Linn.; MERR., Enum. Born. Pl. (1921) 132; Enum. Philip. Fl. Pl. 1 (1924) 247.

Nos. 1529, 1590, in open places. Pantropic, of American origin.

MARANTACEÆ

Genus **DONAX** Loureiro

Donax cannaeformis (Forst. f.) K. Schum.

Donax cannaeformis (Forst. f.) K. Schum.; MERR., Enum. Born. Pl. (1921) 132; Enum. Philip. Fl. Pl. 1 (1924) 248.

No. 1572, in open forests. Java and Borneo to the Philippines, New Guinea, Admiralty Islands, New Hebrides, and the Marianne Islands.

Genus **PHRYNIUM** Willdenow

Phrynium placentarium (Lour.) Merr.

Phrynium placentarium (Lour.) MERR. in Philip. Journ. Sci. 15 (1919) 230. [*Phrynium parviflorum* Roxb.; MERR., Enum. Born. Pl. (1921) 132].

No. 1333, in open forests. India to Hainan, Borneo, and Java, but not known from the Philippines. Loureiro's specific name is older than Roxburgh's and manifestly applies to the same form.

ORCHIDACEÆ [5]

Genus **TROPIDIA** Lindley

Tropidia sp.

No. 1462, on forested slopes. An imperfect specimen, flowers not available.

Genus **AGROSTOPHYLLUM** Blume

Agrostophyllum stipulatum (Griff.) Schltr.

Agrostophyllum stipulatum (Griff.) SCHLTR. in Fedde Repert. Beih. 1 (1914) 279?

No. 1458, epiphytic. There are no flowers, so that the identification is not certain. Not recorded from either Borneo or the Philippines.

Genus **HABENARIA** Willdenow

Habenaria hystrix Ames.

Habenaria hystrix AMES, Orch. 2 (1908) 35; ex Merr. Enum. Philip. Fl. Pl. 1 (1924) 258.

No. 1117, in forests. Philippines and British North Borneo.

Genus **BROMHEADIA** Lindley

Bromheadia finlaysoniana (Lindl.) Reichb. f.

Bromheadia finlaysoniana (Lindl.) Reichb. f.; AMES ex Merr. Enum. Born. Pl. (1921) 180 (*B. palustris* Reichb. f.).

No. 1764, in marshes. Indo-China and the Malay Peninsula through Malaysia to New Guinea. No representative of the genus has been found in the Philippines.

Genus **CALANTHE** R. Brown

Calanthe furcata Batem.

Calanthe furcata Batem.; AMES ex Merr. Enum. Philip. Fl. Pl. 1 (1924) 333 [*C. veratrifolia* R. Br.; ex Merr. Enum. Born. Pl. (1921) 181].

[5] Identifications by Mr. Oakes Ames.

No. 1748, in old clearings. Widely distributed in the Indo-Malaysian region.

Genus **EULOPHIA** R. Brown

Eulophia squalida Lindl.

Eulophia squalida Lindl.; AMES ex Merr. Enum. Born. Pl. (1921) 192; Enum. Philip. Fl. Pl. 1 (1924) 339.

No. 1575, in open forests. Malay Peninsula to Java, Philippines, and Celebes.

Genus **GEODORUM** Jackson

Geodorum nutans (Presl) Ames.

Geodorum nutans (Presl) AMES, Orch. 2 (1908) 164; ex Merr. Enum. Philip. Fl. Pl. 1 (1924) 341.

Nos. 1116, 1574a, in open places at low altitudes. Common and widely distributed in the Philippines, but otherwise not known from outside the Archipelago.

Genus **ERIA** Lindley

Eria floribunda Lindl.

Eria floribunda Lindl.; AMES ex Merr. Enum. Born. Pl. (1921) 170; Enum. Philip. Fl. Pl. 1 (1924) 367.

Nos. 1457, 1686, epiphytic on forested slopes. Burma to Sumatra, Java, Palawan, and Mindanao.

Eria fusca Blume?

Eria fusca Blume?; AMES ex Merr. Enum. Born. Pl. (1921) 170; Enum. Philip. Fl. Pl. 1 (1924) 368.

No. 1685, epiphytic in forests, with larger leaves than the typical form. Java, Borneo, Philippines, Celebes?

Genus **CYMBIDIUM** Swartz

Cymbidium finlaysonianum Lindl.

Cymbidium finlaysonianum Lindl.; AMES ex Merr. Enum. Born. Pl. (1921) 192; Enum. Philip. Fl. Pl. 1 (1925) 403.

No. 1417, on trees along the seashore. Malay Peninsula to Borneo and the Philippines. Identified as *Cymbidium* sp. aff. *aloifolium* Sw. by Mr. Ames, but I cannot see wherein the specimen differs from the common Philippine littoral form referred to *C. finlaysonianum* Lindl. The specimen has fruits, but no flowers.

Genus **SARCOCHILUS** R. Brown

Sarcochilus pallidus (Blume) Reichb. f.

Sarcochilus pallidus (Blume) Reichb. f.; AMES ex Merr. Enum. Born. Pl. (1921) 197; Enum. Philip. Fl. Pl. 1 (1925) 407.

No. 1457, epiphytic, in forests at low altitudes. Malay Peninsula to Java, Philippines, and the Moluccas.

Genus **SARCANTHUS** Lindley

Sarcanthus sp. aff. **S. micranthus** Ames.

No. 1704, epiphytic in forests at low altitudes, a fruiting specimen.

Genus **ACRIOPSIS** Reinwardt

Acriopsis sp.

No. 1753, in forests. A single specimen, perhaps referable to *Acriopsis javanica* Reinw., which extends from Tenasserim to the Philippines and New Guinea.

DICOTYLEDONEÆ

CASUARINACEÆ

Genus **CASUARINA** Linnæus

Casuarina equisetifolia Linn.

Casuarina equisetifolia Linn.; MERR., Enum. Born. Pl. (1921) 204; Enum. Philip. Fl. Pl. 2 (1923) 1.

Nos. 1496, 1752, the latter from Balambangan Island, along the seashore. Old World Tropics, generally near the sea.

Casuarina sumatrana Jungh.

Casuarina sumatrana Jungh.; MERR., Enum. Born. Pl. (1921) 205; Enum. Philip. Fl. Pl. 2 (1923) 1.

No. 1759, from Balambangan Island, in forests, with the local name *aru.* Burma to Java and the Philippines.

PIPERACEÆ

Genus **PIPER** Linnæus

Piper abbreviatum Opiz.

Piper abbreviatum Opiz; MERR., Enum. Philip. Fl. Pl. 2 (1923) 2 [*Piper chaba* Bl., non Hunter; Enum. Born. Pl. (1921) 207].

No. 1605, in forests. Java to the Philippines.

Piper fragile Benth.?

Piper fragile Benth.?; MERR., Enum. Philip. Fl. Pl. 2 (1923) 9.

Nos. 1480, 1594, in open forests and along the seashore. Philippines to New Guinea.

Piper interruptum Opiz.

Piper interruptum Opiz; MERR., Enum. Philip. Fl. Pl. 2 (1923) 9.

No. 1381, in primary forests. Widely distributed in the Philippines, occurring also in New Guinea, but not known from Borneo proper.

CHLORANTHACEÆ

Genus **CHLORANTHUS** Swartz

Cloranthus officinalis Blume.

Chloranthus officinalis Blume; MERR., Enum. Born. Pl. (1921) 209; Enum. Philip. Fl. Pl. 2 (1923) 21.

No. 1383, in primary forests. India to Formosa, through Malaysia to New Guinea.

MYRICACEÆ

Genus **MYRICA** Linnæus

Myrica esculenta Ham. var. **farquarhiana** (Wall.) A. Chev.

Myrica esculenta Ham. var. *farquarhiana* (Wall.) A. Chev.; MERR., Enum. Philip. Fl. Pl. 2 (1923) 23; Enum. Born. Pl. (1921) 210.

No. 1761, in forests. India to China, Borneo, and the Philippines.

FAGACEÆ

Genus **CASTANOPSIS** Spach

Castanopsis woodii sp. nov.

Arbor circiter 5 m alta, glabra vel subglabra, ramis teretibus, glabris, ramulis tenuibus, ultimis circiter 1.5 mm diametro, leviter sulcatis, in siccitate purpureo-brunneis, axillis parce pubescentibus; foliis oblongis ad oblongo-ellipticis, subcoriaceis, glabris, integerrimis, 14 ad 20 cm longis, 5 ad 7 cm latis, tenuiter acute acuminatis, basi leviter inaequilateralibus, acutis vel leviter decurrento-acuminatis, laevis, supra viridibus, nitidis, subtus paullo pallidioribus; nervis primariis utrinque circiter 14, perspicuis; petiolo 1 ad 1.5 cm longo; floribus ignotis; infructescentiis spicatis, pedunculatis, 10 ad 29 cm longis, pedunculo 5 ad 15 cm longo, involucris paucis, solitariis vel 3-fasciculatis, sessilibus, 4 ad 5 cm longis, circiter 3 cm diametro, aequilateralibus vel leviter inaequilateralibus, extus glabris vel subglabris, spinis numerosis fasciculatis rigidis subulatis rectis vel curvatis 6 ad 15 mm longis instructis; glans solitariis, ellipsoideis vel ovoideis, 3 ad 3.5 cm longis, glabris.

BANGUEY ISLAND, *1396 P. Castro and F. Melegrito,* August 5, 1923, in open forests at low altitudes.

This very characteristic species does not appear to be closely allied to any of the previously described forms. The walls of the involucre are about 2 mm thick, glabrous on both surfaces, the slender rigid spines being sparingly pubescent. The tufts of spines do not cover the entire surface of the involucre, and are irregularly arranged, each being usually trichotomously branched, the stout basal part 1 to 2 mm in length. The nuts are solitary, closely attached to the involucre throughout, the bony wall being nearly as thick as the involucre wall, glabrous externally and pale pubescent within. There are rarely more than three involucres to a spike, and these may be either rather distant or crowded at the end.

Genus QUERCUS Tournefort

Quercus conocarpa Oudem.

Quercus conocarpa Oudem.; MERR., Enum. Born. Pl. (1921) 212.

No. 1450, in forests, altitude 200 meters. The specimen has immature buds but agrees closely in the characters presented by it with Oudeman's species. Malay Peninsula, Sumatra, Java, and Borneo, but not known from the Philippines.

Quercus poculiformis Von Seem.?

Quercus poculiformis Von Seem.?; MERR., Enum. Born. Pl. (1921) 215.

No. 1658, in forests, altitude about 30 meters. The specimen does not agree sufficiently well with the description to warrant referring it here without doubt. Borneo and Bangka, not in the Philippines.

ULMACEÆ

Genus TREMA Linnæus

Trema orientalis (Linn.) Blume.

Trema orientalis (Linn.) Blume; MERR., Enum. Born. Pl. (1921) 217; Enum. Philip. Fl. Pl. 2 (1923) 34.

No. 1536, in open places. India to southern China, through Malaysia to tropical Australia and Polynesia.

MORACEÆ

Genus PRAINEA King

Prainea multinervia sp. nov.

Arbor circiter 8 m alta, ramulis leviter pubescentibus pedunculisque obscure furfuraceis exceptis glabra, ramulis 4 ad 5 mm

diametro; foliis oblongis, chartaceis, integris, 25 ad 30 cm longis, 8 ad 10 cm latis, in siccitate olivaceis vel brunneis, nitidis, vix puncticulatis, basi distincte inaequilateralibus, obtusis ad rotundatis, apice abrupte subcaudato-acuminatis, nervis primariis utrinque 18 ad 20, patulis, perspicuis, petiolo 1 ad 1.5 cm longo; receptaculis ♂ e axillis defoliatis, globosis, 2 cm diametro, pedunculo circiter 8.5 cm longo, sursum leviter incrassato; perigoniis liberis, cylindraceis, glabris, sursum leviter incrassatis, 5 ad 6 mm longis, brevissime 4-lobatis, lobis obtusis, circiter 0.5 mm longis, ovario glabro, 3 mm longo, stylis circiter 2 mm longis, bracteis interflorales numerosis, filiformibus, pilosis, 6 mm longis, apice incrassatis. Floribus ♀ fructibusque ignotis.

BANGUEY ISLAND, *1610 P. Castro and F. Melegrito,* August 8, 1923 (type), in forests at low altitudes. Also represented by *D. D. Wood 1790,* from Kimanis, British North Borneo, with the local name *kasusu,* with a note to the effect that the fruit is edible.

The third representative of this small genus to be recorded from Borneo; no representative of it is known from the Philippines. It is apparently most closely allied to *Prainea cuspidata* Becc. which Renner has reduced to *Artocarpus limpato* Miq., although the two descriptions do not well agree. The present species differs from *Prainea cuspidata* Becc. in its more numerously nerved leaves which are not puncticulate, as well as in its somewhat pubescent branchlets and furfuraceous not glabrous peduncles.

Genus **ANTIARIS** Leschenault

Antiaris toxicaria (Pers.) Lesch.

Antiaris toxicaria (Pers.) Lesch.; MERR., Enum. Born. Pl. (1921) 220; Enum. Philip. Fl. Pl. 2 (1923) 44.

No. 1135, on forested slopes. India to southern China and Malaysia.

Genus **FICUS** Tournefort

Ficus fistulosa Reinw.

Ficus fistulosa Reinw.; MERR. Enum. Born. Pl. (1921) 223.

No. 1602, in forests. India to Malaysia, probably represented in the Philippines by *Ficus repandifolia* Elm. (*F. rubrovenia* Merr.), which is doubtfully distinct from Reinwardt's species.

Ficus palawanensis Merr.

Ficus palawanensis MERR., Enum. Philip. Fl. Pl. 2 (1923) 60.

No. 1361, in forests near the sea. Luzon to Mindanao and Palawan in the Philippines, but not known from Borneo proper.

Ficus retusa Linn.

Ficus retusa Linn.; MERR., Enum. Born. Pl. (1921) 226; Enum. Philip. Fl. Pl. 2 (1923) 63.

No. 1694, near the seashore. India to Formosa through Malaysia to tropical Australia and New Caledonia.

Ficus septica Burm. f.

Ficus septica Burm. f.; MERR., Enum. Born. Pl. (1921) 227.

No. 1514, in open places. Widely distributed in the Malay Archipelago, represented in the Philippines by *Ficus hauili* Blanco, which is perhaps not sufficiently distinct to warrant specific recognition. This form is more commonly known as *Ficus leucantatoma* Poir.

Genus **CONOCEPHALUS** Blume

Conocephalus suaveolens Blume.

Conocephalus suaveolens Blume; MERR., Enum. Born. Pl. (1921) 229; Enum. Philip. Fl. Pl. 2 (1923) 229.

No. 1488, in open forests. India to Malaysia, common.

URTICACEÆ

Genus **PROCRIS** Commerson

Procris frutescens Blume.

Procris frutescens Blume; MERR., Enum. Born. Pl. (1921) 233 (*P. pseudostrigosa* Elm.); Enum. Philip. Fl. Pl. 2 (1923) 88.

No. 1688, epiphytic in mangrove swamps. Malay Peninsula to Java, Borneo, and the Philippines.

Genus **POUZOLZIA** Gaudichaud

Pouzolzia zeylanica (Linn.) Benn.

Pouzolzia zeylanica (Linn.) Benn.; MERR., Enum. Born. Pl. (1921) 233; Enum. Philip. Fl. Pl. 2 (1923) 92.

No. 1707, in open places. Throughout the Indo-Malaysian region.

Genus **PIPTURUS** Weddell

Pipturus argenteus (Forst.) Wedd.

Pipturus argenteus (Forst.) Wedd.; MERR., Enum. Born. Pl. (1921) 234; Enum. Philip. Fl. Pl. 2 (1923) 94.

No. 1555, in open places at low altitudes. Sumatra to tropical Australia and eastern Polynesia.

Genus **LEUCOSYKE** Moritzi

Leucosyke capitellata (Poir.) Wedd.

Leucosyke capitellata (Poir.) Wedd.; MERR., Enum. Born. Pl. (1921) 234; Enum. Philip. Fl. Pl. 2 (1923) 96.

No. 1513, in open places at low altitudes. Formosa to Java and New Guinea.

LORANTHACEÆ

Genus **LORANTHUS** Linnæus

Loranthus estipitatus Stapf.

Loranthus estipitatus Stapf; MERR., Enum. Born. Pl. (1921) 237.

No. 1331, parasitic in open forests. This is replaced in the Philippines and in southern China by the very closely allied species *Loranthus parasiticus* (Linn.) Merr.

Loranthus sp.

No. 1463, parasitic on trees along the seashore. A very characteristic species also represented by *1183 Wood* from British North Borneo, but from the material available I have been able to place it in its proper subgenus. There are no mature flowers.

AMARANTHACEÆ

Genus **DEERINGIA** R. Brown

Deeringia polysperma (Roxb.) Moq.

Deeringia polysperma (Roxb.) Moq.; MERR., Enum. Philip. Fl. Pl. 2 (1923) 126.

No. 1637, near the seashore. Malay Peninsula to the Philippines and the Moluccas, although not recorded from Borneo proper.

Genus **CELOSIA** Linnæus

Celosia argentea Linn.

Celosia argentea Linn.; MERR., Enum. Born. Pl. (1921) 245; Enum. Philip. Fl. Pl. 2 (1923) 127.

In cultivated land, a form approaching *Celosia cristata* Linn. Pantropic.

Genus **CYATHULA** Loureiro

Cyathula prostrata (Linn.) Blume.

Cyathula prostrata (Linn.) Blume; MERR., Enum. Born. Pl. (1921) 246; Enum. Philip. Fl. Pl. 2 (1923) 129.

No. 1477, in open places. A pantropic weed.

Genus **AMARANTHUS** Linnæus

Amaranthus paniculatus Linn.

Amaranthus paniculatus Linn.; Merr., Enum. Philip. Fl. Pl. 2 (1923) 128.

No. 1425, in cultivated land. Pantropic, cultivated and wild, but not recorded from Borneo proper.

Amaranthus viridis Linn.

Amaranthus viridis Linn.; Merr., Enum. Born. Pl. (1921) 246; Enum. Philip. Fl. Pl. 2 (1923) 128.

Nos. 1541, 1559, in open places. A pantropic weed.

Genus **GOMPHRENA** Linnæus

Gomphrena globosa Linn.

Gomphrena globosa Linn.; Merr., Enum. Born. Pl. (1921) 246; Enum. Philip. Fl. Pl. 2 (1923) 132.

No. 1548, in open places. Pantropic, cultivated and wild.

NYCTAGINACEÆ

Genus **MIRABILIS** Linnæus

Mirabilis jalapa Linn.

Mirabilis jalapa Linn.; Merr., Enum. Philip. Fl. Pl. 2 (1923) 132.

No. 1355, in open places, apparently here an escape from cultivation. Pantropic, cultivated and naturalized, a native of Mexico, not recorded from Borneo proper.

MENISPERMACEÆ

Genus **PYCNARRHENA** Miers

Pycnarrhena elliptica Diels.

Pycnarrhena elliptica Diels in Engl. Pflanzenreich 46 (1910) 54; Merr., Enum. Philip. Fl. Pl. 2 (1923) 144.

No. 1583, near the seashore. Previously known only from Palawan.

Genus **COSCINUM** Colebrooke

Coscinum fenestratum (Gaertn.) Colebr.

Coscinum fenestratum (Gaertn.) Colebr.; Merr., Enum. Born. Pl. (1921) 248.

No. 1657, in forests at low altitudes. India to Ceylon, Sumatra, and Borneo. No representative of the genus is known from the Philippines.

The specimen is in fruit; flowers are desirable. Dr. L. Diels, to whom I submitted a specimen, states that this identification is correct so far as the material goes. There is a good deal of heterophylly in the genus and the limits of the few species are not satisfactorily known.

Genus **TINOSPORA** Miers

Tinospora reticulata Miers.

Tinospora reticulata Miers; MERR., Enum. Philip. Fl. Pl. 2 (1923) 146.

No. 1434, near the seashore. Previously known only from the Philippines, where it occurs throughout the group, from the Batan Islands to Mindanao and Palawan.

The identification is by Doctor Diels, who states that, in the absence of flowers and although the fruits are immature, he is fairly certain that the specimen belongs to this species.

Genus **PERICAMPYLUS** Miers

Pericampylus glaucus (Lam.) Merr.

Pericampylus glaucus (Lam.) MERR., Enum. Born. Pl. (1921) 250; Enum. Philip. Fl. Pl. 2 (1923) 148.

No. 1547, in open places. India through Malaysia to the Moluccas.

Genus **STEPHANIA** Loureiro

Stephania sp.

No. 1609, in forests.

ANONACEÆ

Genus **UVARIA** Linnæus

Uvaria micrantha (DC.) Hook. f. & Th.

Uvaria micrantha (DC.) Hook. f. & Th.; MERR., Enum. Philip. Fl. Pl. 2 (1923) 155.

No. 1122, in forests. Burma to Sumatra, Borneo, and the Philippines.

Uvaria purpurea Blume.

Uvaria purpurea Blume; MERR., Enum. Born. Pl. (1921) 254; Enum. Philip. Fl. Pl. 2 (1923) 156.

Nos. 1134, 1687, in forests near the seashore. Southeastern China to Malaysia.

Genus **PSEUDUVARIA** Miquel

Pseuduvaria sp.?

No. 1363, in primary forests. The specimen is in fruit; flowers are essential to determine its proper generic position.

Genus **GONIOTHALAMUS** Hooker f. and Thomson

Goniothalamus sp.

Nos. 1129, 1607, in forests. The same as a form that occurs in British North Borneo, probably undescribed, but the material is too fragmentary.

Genus **MITREPHORA** Hooker f. and Thomson

Mitrephora williamsii C. B. Rob.

Mitrephora williamsii C. B. Rob.; MERR., Enum. Philip. Fl. Pl. 2 (1923) 169.

No. 1523, in second-growth forests. Mindanao.

Genus **DASYMASCHALON** Blume

Dasymaschalon clusiflorum Merr.

Dasymaschalon clusiflorum MERR., Enum. Philip. Fl. Pl. 2 (1923) 175.

No. 1385, in primary forests. Throughout the Philippines but, other than this collection, not known outside of the Archipelago.

Genus **ANONA** Linnæus

Anona muricata Linn.

Anona muricata Linn.; MERR., Enum. Born. Pl. (1921) 267; Enum. Philip. Fl. Pl. 2 (1923) 177.

No. 1395, cultivated. Pantropic in cultivation, native of tropical America. The soursop.

MYRISTICACEÆ

Genus **MYRISTICA** Linnæus

Myristica guatteriaefolia A.DC.

Myristica guatteriaefolia A.DC.; MERR., Enum. Born. Pl. (1921) 296; Enum. Philip. Fl. Pl. 2 (1923) 178.

No. 1624, in forests. Throughout the Philippines, also in British North Borneo and in Labuan.

Genus **KNEMA** Loureiro

Knema glomerata (Blanco) Merr.

Knema glomerata (Blanco) MERR., Enum. Born. Pl. (1921) 270; Enum. Philip. Fl. Pl. 2 (1923) 183.

No. 1451, in primary forests, altitude 200 meters. Philippines and British North Borneo.

MONIMIACEÆ

Genus KIBARA Endlicher

Kibara motleyi Perk.

Kibara motleyi Perk.; MERR., Enum. Born. Pl. (1921) 272.

No. 1639, in forests, altitude about 30 meters. This is described as a tree 15 feet high, but Perkins describes the species as a vine. The other characters agree better with the description of *Kibara motleyi* Perk. than with *K. cuspidata* Blume. Previously known only from Labuan.

LAURACEÆ

Genus ACTINODAPHNE Nees

Actinodaphne sp.?

No. 1390, in open forests. The specimen is in fruit; flowers are necessary to place it with certainty in the genus.

Genus LITSEA Lamarck

Litsea amara Blume.

Litsea amara Blume; MERR., Enum. Born. Pl. (1921) 275.

Nos. 1394, 1420, in forests. Burma to Sumatra, Java, and Borneo, but not known from the Philippines.

Genus CRYPTOCARYA R. Brown

Cryptocarya sp.

No. 1386, in primary forests. The specimen has immature fruits. It is apparently allied to *Cryptocarya palawanensis* Merr.

Genus CASSYTHA Linnæus

Cassytha filiformis Linn.

Cassytha filiformis Linn.; MERR., Enum. Born. Pl. (1921) 280; Enum. Philip. Fl. Pl. 2 (1923) 204.

No. 1664, along the seashore. Pantropic.

HERNANDIACEÆ

Genus HERNANDIA Plumier

Hernandia ovigera Linn.

Hernandia ovigera Linn.; MERR., Enum. Philip. Fl. Pl. 2 (1923) 206.
Hernandia peltata Meisn.; MERR., Enum. Born. Pl. (1921) 280.

No. 1426, along the seashore. A characteristic strand tree extending from eastern Africa to Polynesia.

CAPPARIDACEÆ

Genus **CAPPARIS** Tournefort

Capparis micracantha DC.

Capparis micracantha DC.; MERR., Enum. Philip. Fl. Pl. 2 (1923) 212.

No. 1640, near the seashore. Burma and Indo-China to the Moluccas, but not rēported from Borneo proper.

Genus **CRATAEVA** Linnæus

Crataeva macrocarpa Kurz.

Crataeva macrocarpa KURZ in Journ. Bot. 12 (1874) 195, *t. 148.*

No. 1482, near the seashore. Indo-China and the Malay Peninsula. No representative of the genus has hitherto been recorded from Borneo.

NEPENTHACEÆ

Genus **NEPENTHES** Linnæus

Nepenthes rafflesiana Jack.

Nepenthes rafflesiana Jack; MERR., Enum. Born. Pl. (1921) 284.

No. 1751, from Balambangan Island, in fresh-water swamp at low altitudes, det. Macfarlane. Malay Peninsula, Sumatra, Bangka.

ROSACEÆ

Genus **RUBUS** Tournefort

Rubus moluccanus Linn.

Rubus moluccanus Linn.; MERR., Enum. Born. Pl. (1921) 288; Enum. Philip. Fl. Pl. 2 (1923) 228.

No. 1667, at low altitudes. Widely distributed in the Indo-Malaysian region, extending to western Polynesia.

CONNARACEÆ

Genus **CONNARUS** Linnæus

Connarus stellatus Merr.

Connarus stellatus MERR. in Philip. Journ. Sci. 4 (1909) Bot. 119; Enum. Philip. Fl. Pl. 2 (1923) 238.

No. 1470, near the seashore. A species previously known only from the neighboring island of Balabac, in the Philippine group.

LEGUMINOSÆ

Genus **PITHECOLOBIUM** Martius

Pithecolobium motleyanum Benth.?

Pithecolobium motleyanum Benth.?; MERR., Enum. Born. Pl. (1921) 293.

No. 1376, in primary forests. A species known only from Borneo; the identification of the cited specimen uncertain.

Genus **ALBIZZIA** Durazzini

Albizzia retusa Benth.

Albizzia retusa Benth.; MERR., Enum. Philip. Fl. Pl. 2 (1923) 247.

No. 1506, along the seashore. Not recorded from Borneo proper, although certainly occurring there. A strand tree extending from the Nicobar Islands throughout Malaysia and the Philippines to the Caroline Islands.

Genus **ENTADA** Adanson

Entada phaseoloides (Linn.) Merr.

Entada phaseoloides (Linn.) MERR., Enum. Born. Pl. (1921) 295; Enum. Philip. Fl. Pl. 2 (1923) 252.

Nos. 1119, 1337, 1691, in open forests. Pantropic.

Genus **CYNOMETRA** Linnæus

Cynometra bijuga Spanoghe var. **mimosoides** (Wall.) Merr.

Cynometra bijuga Spanoghe var. *mimosoides* (Wall.) MERR., Enum. Philip. Fl. Pl. 2 (1923) 254.

No. 1638, along the seashore. This is possibly the form recorded from Borneo proper as *Cynometra ramiflora* Linn. India to Malaysia.

Genus **CAESALPINIA** Linnæus

Caesalpinia crista Linn.

Caesalpinia crista Linn.; MERR., Enum. Born. Pl. (1921) 300; Enum. Philip. Fl. Pl. 2 (1923) 266.

No. 1700, along the seashore. A pantropic strand plant.

Caesalpinia pulcherrima (Linn.) Sw.

Caesalpinia pulcherrima (Linn.) Sw.; MERR., Enum. Born. Pl. (1921) 301; Enum. Philip. Fl. Pl. 2 (1923) 267.

No. 1549, near the seashore. Pantropic in cultivation, native of tropical America.

Caesalpinia sappan Linn.

Caesalpinia sappan Linn.; MERR., Enum. Born. Pl. (1921) 301; Enum. Philip. Fl. Pl. 2 (1923) 247.

Nos. 1353, 1749, the latter from Balambangan Island. In old clearings. Widely distributed in the Old World Tropics.

Genus **MEZONEURUM** Desfontaines

Mezoneurum latisliquum (Cav.) Merr.

Mezoneurum latisiliquum (Cav.) MERR., Enum. Philip. Fl. Pl. 2 (1923) 268.

No. 1537, in forests. Widely distributed in the Philippines, occurring also in Timor; not recorded from Borneo proper.

Genus **PELTOPHORUM** Vogel

Peltophorum inerme (Roxb.) Naves.

Peltophorum inerme (Roxb.) Naves; MERR., Enum. Born. Pl. (1921) 301; Enum. Philip. Fl. Pl. 2 (1923) 269.

No. 1428, along the seashore. Indo-China to the Andaman Islands through Malaysia to tropical Australia.

Genus **SOPHORA** Linnæus

Sophora tomentosa Linn.

Sophora tomentosa Linn.; MERR. Enum. Born. Pl. (1921) 302; Enum. Philip. Fl. Pl. 2 (1923) 270.

Nos. 1634, 1743, the latter from Balambangan Island, along the seashore. A pantropic strand plant.

Genus **CROTALARIA** Dillenius

Crotalaria retusa Linn.

Crotalaria retusa Linn.; MERR., Enum. Philip. Fl. Pl. 2 (1923) 273.

No. 1659, in open places. A pantropic weed, although not definitely recorded from Borneo proper.

Genus **WHITFORDIODENDRON** Elmer

Whitfordiodendron nieuwenhuisii (J. J. Sm.) comb. nov.

Millettia nieuwenhuisii J. J. SM. in Bull. Dept. Agr. Neérl. Ind. 3 (1906) 17.

Adinabotrys nieuwenhuisii DUNN in Kew Bull. (1911) 196; MERR., Enum. Born. Pl. (1921) 303.

No. 1335, in open forests. A species hitherto known only from Borneo proper.

Genus **DESMODIUM** Desvaux

Desmodium heterocarpum (Linn.) DC.

Desmodium heterocarpum (Linn.) DC.; MERR., Enum. Born. Pl. (1921) 304; Enum. Philip. Fl. Pl. 2 (1923) 285.

No. 1692, in open places. Old World Tropics generally.

Desmodium umbellatum (Linn.) DC.

Desmodium umbellatum (Linn.) DC.; MERR., Enum. Born. Pl. (1921) 305; Enum. Philip. Fl. Pl. 2 (1923) 290.

Nos. 1351, 1413, along the seashore. Old World Tropics generally, along the seashore.

Genus **DALBERGIA** Linnæus f.

Dalbergia candenatensis (Dennst.) Prain.

Dalbergia candenatensis (Dennst.) Prain; MERR., Enum. Born. Pl. (1921) 306; Enum. Philip. Fl. Pl. 2 (1923) 294.

No. 1448, a littoral species extending from India to southern China, New Guinea, tropical Australia, and the Caroline and Marianne Islands.

Genus **PONGAMIA** Ventenant

Pongamia pinnata (Linn.) Merr.

Pongamia pinnata (Linn.) MERR., Enum. Born. Pl. (1921) 307; Enum. Philip. Fl. Pl. 2 (1923) 298.

No. 1715, along the seashore. A littoral species extending from tropical Asia to tropical Australia and Polynesia.

Genus **DERRIS** Loureiro

Derris trifoliata Lour.

Derris trifoliata Lour.; MERR., Enum. Born. Pl. (1921) 308; Enum. Philip. Fl. Pl. 2 (1923) 301.

No. 1500, along the seashore. Old World Tropics generally, within the influence of salt or brackish water.

Genus **CLITORIA** Linnæus

Clitoria ternatea Linn.

Clitoria ternatea Linn.; MERR., Enum. Born. Pl. (1921) 309; Enum. Philip. Fl. Pl. 2 (1923) 303.

No. 1587, in waste places. Pantropic.

Genus **MUCUNA** Adanson

Mucuna gigantea (Willd.) DC.

Mucuna gigantea (Willd.) DC.; MERR., Enum. Born. Pl. (1921) 309; Enum. Philip. Fl. Pl. 2 (1923) 308.

No. 1415, near the seashore. India to Polynesia, near the sea.

Genus **SPATHOLOBUS** Hasskarl

Spatholobus gyrocarpus (Wall.) Benth.

Spatholobus gyrocarpus (Wall.) Benth.; MERR., Enum. Born. Pl. (1921) 310; Enum. Philip. Fl. Pl. 2 (1923) 310.

Nos. 1530, 1679, in forests. Malay Peninsula, Borneo, and the Philippines.

Genus **CANAVALIA** de Candolle

Canavalia microcarpa (DC.) Piper.

Canavalia microcarpa (DC.) Piper; MERR., Enum. Philip. Fl. Pl. 2 (1923) 313.

No. 1571, in thickets and open forests. India to southern China, Malaysia, and Polynesia, but not definitely recorded from Borneo proper.

Canavalia maritima (Aubl.) Thouars.

Canavalia maritima (Aubl.) THOUARS in Desv. Journ. de Bot. 1 (1813) 80; PIPER in Contr. U. S. Nat. Herb. 20 (1925) 564.
Dolichos maritimus AUBL., Pl. Guian. Franc. (1775) 765.
Canavalia rosea DC.; MERR., Enum. Philip. Fl. Pl. 2 (1923) 313.
Canavalia lineata MERR., Enum. Born. Pl. (1921) 310, non DC.

No. 1498, on sandy seashores. A pantropic strand plant for which the oldest specific name is that indicated above, as shown by Piper l. c.

Genus **VIGNA** Savi

Vigna marina (Burm.) Merr.

Vigna marina (Burm.) MERR., Enum. Philip. Fl. Pl. 2 (1923) 320.

No. 1585, along the seashore. A pantropic strand plant more commonly known as *Vigna lutea* A. Gray; not recorded from Borneo proper, but certainly occurring there.

Genus **DOLICHOS** Linnæus

Dolichos lablab Linn.

Dolichos lablab Linn.; MERR., Enum. Born. Pl. (1921) 311, in note; Enum. Philip. Fl. Pl. 2 (1923) 321.

No. 1478, in cultivated land. Pantropic in cultivation, often naturalized.

SIMARUBACEÆ

Genus **BRUCEA** J. S. Miller

Brucea amarissima (Lour.) Desv.

Brucea amarissima (Lour.) DESV. ex Gomes in Mém. Acad. Sci. Lisb. N. S. 4 (1872) 30; MERR., Enum. Born. Pl. (1921) 316; Enum. Philip. Fl. Pl. 2 (1923) 347.

No. 1341, in open forests. India to southern China through Malaysia to tropical Australia.

Desvaux is the author of the first transfer of Loureiro's specific name, as indicated above. The species is more commonly known as *Brucea sumatrana* Roxb.

Genus **EURYCOMA** Jack

Eurycoma longifolia Jack.

Eurycoma longifolia Jack; MERR., Enum. Born. Pl. (1921) 316.

No. 1750, from Balambangan Island, on open slopes. Indo-China, the Malay Peninsula, Sumatra, Java, and Borneo, but not known from the Philippines, where the genus is represented by an allied species.

Genus **SOULAMEA** Lamarck

Soulamea amara Lam.

Soulamea amara LAM., Encycl. 1 (1785) 449.

No. 1464, along the seashore. Moluccas to the Bismarck Archipelago. No representative of the genus is known from either Borneo proper or the Philippines.

RUTACEÆ

Genus **EVODIA** Forster

Evodia bintoco Blanco.

Evodia bintoco Blanco; MERR., Enum. Philip. Fl. Pl. 2 (1923) 328.

No. 1721, in open places. Widely distributed in the central and southern Philippines; also occurring in British North Borneo.

Genus **MICROMELUM** Blume

Micromelum minutum (Forst. f.) Seem.

Micromelum minutum (Forst. f.) Seem.; MERR., Enum. Philip. Fl. Pl. 2 (1923) 335.

No. 1638, near the seashore. Curiously, no representative of this genus is recorded from Borneo proper, although the pres-

ent species, more commonly known as *Micromelum pubescens* Blume, certainly occurs there. India to southern China through Malaysia to tropical Australia and Polynesia.

Genus CLAUSENA Burman f.

Clausena excavata Burm. f.

Clausena excavata Burm. f.; MERR., Enum. Born. Pl. (1921) 314; Enum. Philip. Fl. Pl. 2 (1923) 337.

No. 1332, in open forests. India to Indo-China and Malaysia, occurring in the Philippines only in those parts nearest Borneo, Palawan to Mindoro, and in the Sulu Archipelago.

Genus ATALANTIA Correa

Atalantia disticha (Blanco) Merr.

Atalantia disticha (Blanco) MERR., Enum. Philip. Fl. Pl. 2 (1923) 339.

No. 1665, near the seashore. Throughout the Philippines, but otherwise not known from outside of the Archipelago.

Atalantia sp.?

Nos. 1348, 1713, in primary forests.

A strongly marked species, of which unfortunately no flowers are available. Most of the petioles are winged, as in *Citrus aurantifolia* Swingle, and are jointed as in *Citrus.* The fruits are fleshy, globose, 1.5 to 2 cm in diameter, few-seeded, resembling *Citrus.* The sepals are linear or strap-shaped, free, persistent, 1 cm long and about 1.5 mm wide, in this character the species differing from both *Citrus* and *Atalantia.* Dr. W. T. Swingle, who has examined a specimen, states that the segment walls are covered with hairlike structures homologous to the pulp vesicles of *Citrus,* but with this form, as in other species of *Atalantia,* they are simply hairlike structures and not true pulp vesicles. Perhaps an undescribed genus is represented here.

BURSERACEÆ

Genus CANARIUM Linnæus

Canarium villosum (Blume) F.-Vill.

Canarium villosum (Blume) F.-Vill.; MERR., Enum. Philip. Fl. Pl. 2 (1923) 354.

No. 1433, in forests. Abundant throughout the Philippines, but hitherto not known from outside the Archipelago.

MELIACEÆ

Genus XYLOCARPUS Koenig

Xylocarpus granatum Koenig.

Xylocarpus granatum Koenig; MERR., Enum. Born. Pl. (1921) 318; Enum. Philip. Fl. Pl. 2 (1923) 258.

No. 1365, along tidal streams. India to New Caledonia.

Genus CHISOCHETON Blume

Chisocheton pentandrus (Blanco) Merr.

Chisocheton pentandrus (Blanco) MERR., Enum. Philip. Fl. Pl. 2 (1923) 367.

Nos. 1441, 1612, in forests. Common throughout the Philippines, but hitherto not known from outside the Archipelago.

Genus DYSOXYLUM Blume

Dysoxylum arborescens (Blume) Miq.

Dysoxylum arborescens (Blume) Miq.; MERR., Enum. Born. Pl. (1921) 320; Enum. Philip. Fl. Pl. 2 (1923) 362.

No. 1503, near the seashore. Sumatra to Indo-China through Malaysia to Celebes, Ceram, and the Philippines.

Genus APHANAMIXIS Blume

Aphanamixis tripetala (Blanco) Merr.

Aphanamixis tripetala (Blanco) MERR., Enum. Philip. Fl. Pl. 2 (1923) 370.

No. 1431, in forests, altitude 30 meters. Widely distributed in the Philippines but hitherto not known from outside the Archipelago, unless this Philippine form be reducible to *Aphanamixis rohituka* Pierre.

Genus AGLAIA Loureiro

Aglaia affinis Merr.

Aglaia affinis MERR., Enum. Philip. Fl. Pl. 2 (1923) 371.

Nos. 1403, 1442, 1604, in forests at low altitudes. The specimens are all with fruits, hence the identification is somewhat doubtful. The species to which they are referred occurs in Balabac Island and in western Mindanao. In many respects the material resembles the Javan *Aglaia odoratissima* Blume.

Aglaia cumingiana Turcz.

Aglaia cumingiana Turcz.; MERR., Enum. Philip. Fl. Pl. 2 (1923) 372.

No. 1474, in forests at low altitudes. Throughout the Philippines, but hitherto not reported from outside the Archipelago.

No. 1625, a specimen with immature fruit, apparently represents a species of this genus allied to *Aglaia cumingiana.* The younger parts are, however, somewhat lepidote, not glabrous.

Aglaia multifoliola Merr.

Aglaia multifoliola Merr., Enum. Philip. Fl. Pl. 2 (1923) 377.

No. 1471, in forests. Central and southern Philippines and the Moluccas; not recorded from Borneo proper.

Aglaia sp.

No. 1449, in forests. A very strongly marked species, apparently belonging in the group with *Aglaia hemsleyi* Koord. The specimen is with fruits; flowers are essential.

Genus **WALSURA** Roxburgh

Walsura sp.

Nos. 1366, 1596, in primary forests. Both specimens are with fruits and apparently represent a species closely allied to the Philippine *Walsura villamilii* Merr.

MALPIGHIACEÆ

Genus **TRISTELLATEIA** Thouars

Tristellateia australasiae A. Rich.

Tristellateia australasiae A. Rich.; Merr., Enum. Born. Pl. (1921) 324; Enum. Philip. Fl. Pl. 2 (1923) 380.

No. 1621, along the seashore. Within the influence of salt or brackish water, from the Malay Peninsula to New Caledonia.

POLYGALACEÆ

Genus **XANTHOPHYLLUM** Roxburgh

Xanthophyllum sp.

No. 1673, in forests. Apparently very closely allied to *Xanthophyllum stipitatum* Benn. of the Malay Peninsula, and like that species bearing edible fruits. Unfortunately, no flowers are present and the old fruits collected are in very fragmentary condition. Mr. Melegrito states that the fruit is green and yellow when ripe and is one of the most valuable native fruits on the island.

EUPHORBIACEÆ

Genus **GLOCHIDION** Forster

Glochidion kollmannianum (Muell.-Arg.) J. J. Sm.

Glochidion kollmannianum (Muell.-Arg.) J. J. Sm.; Merr., Enum. Born. Pl. (1921) 328.

No. 1517, in open places. Java, Borneo, and Celebes; not known from the Philippines.

Glochidion littorale Blume.

Glochidion littorale Blume; MERR., Enum. Born. Pl. (1921) 328; Enum. Philip. Fl. Pl. 2 (1923) 399.

No. 1566, along the seashore. India to Java, Borneo, and the Philippines near the sea.

Glochidion rubrum Blume var.?

Glochidion rubrum Blume var.?; MERR., Enum. Philip. Fl. Pl. 2 (1923) 402.

Nos. 1518, 1730, the latter from Balambangan Island, in open places. The specimens closely approximate Bornean material received from Buitenzorg under the name *G. rubrum* Bl. var. *longistylum.* The species extends from the Malay Peninsula to Sumatra, Java, Borneo, and the Philippines.

Genus **DRYPETES** Vahl

Drypetes littoralis (C. B. Rob.) comb. nov.

Cyclostemon littoralis C. B. ROB. in Philip. Journ. Sci. 3 (1908) Bot. 198; MERR., Enum. Philip. Fl. Pl. 2 (1923) 407.

No. 1620, near the seashore. Northern and central Philippines, extending to Palawan, but not known from Borneo proper. Pax and Hoffmann reduce this species to *Drypetes cumingii* (Baill.) Pax and Hoffm., a disposition of it that I am not prepared to accept.

Drypetes sp.

No. 1563, in forests. Probably undescribed, but flowering material desirable.

Genus **ANTIDESMA** Burman

Antidesma bangueyense Merr.

Antidesma bangueyense MERR. in Philip. Journ. Sci. 24 (1924) 114.

Nos. 1121, 1539, in forests. A species known only from this island.

Antidesma bunius (Linn.) Spreng.

Antidesma bunius (Linn.) Spreng.; MERR., Enum. Philip. Fl. Pl. 2 (1923) 412.

No. 1519, in open places. India to southern China, through Malaysia to tropical Australia.

Antidesma montanum Blume.

Antidesma montanum Blume; PAX & HOFFM. in Engl. Pflanzenreich 81 (1922) 158.

Nos. 1494, 1641, near the seashore. Certainly representing Blume's species, as interpreted by Pax and Hoffmann. India to southern China, Malaysia, and the Philippines. *Antidesma moritzii* Muell.-Arg.[6] belongs here.

Genus **CLEISTANTHUS** Hooker f.

Cleistanthus sumatranus (Miq.) Muell.-Arg.

Cleistanthus sumatranus (Miq.) Muell.-Arg.; MERR., Enum. Born. Pl. (1921) 335.

No. 1660, along the seashore. Singapore and Sumatra to Java, Borneo, Celebes, and the Aru Islands.

Cleistanthus sp.

No. 1599, in level forests. A species, possibly undescribed, apparently belonging in the section *Nanopetalum.* No flowers available.

Genus **DAPHNIPHYLLUM** Kurz

Daphniphyllum bancanum Kurz.

Daphniphyllum bancanum Kurz; ROSENTHAL in Engl. Pflanzenreich 68[5] (1919) 12.

Nos. 1724, 1767, both from Balambangan. In forests near mangrove swamps. Previously known only from Bangka, but by some authors reduced to *Daphniphyllum laurinum* Baill., which extends from the Malay Peninsula to Sumatra, Java, and Borneo.

Genus **CROTON** Linnæus

Croton argyratus Blume.

Croton argyratus Blume; MERR., Enum. Born. Pl. (1921) 336; Enum. Philip. Fl. Pl. 2 (1923) 425.

No. 1565, at low altitudes. Burma to Java and the Philippines.

Croton caudatus Geisel.

Croton caudatus Geisel.; MERR., Enum. Born. Pl. (1921) 336; Enum. Philip. Fl. Pl. 2 (1923) 425.

No. 1339, in open forests. Burma to Java and the Philippines.

[6] Merrill, Enum. Born. Pl. (1921) 332.

Croton heterocarpus Muell.-Arg.

Croton heterocarpus Muell.-Arg.; MERR., Enum. Born. Pl. (1921) 337; Enum. Philip. Fl. Pl. 2 (1923) 426.

No. 1439, near mangrove swamps. Malay Peninsula, Sumatra, Java, Borneo, and Palawan.

Croton tiglium Linn.

Croton tiglium Linn.; MERR., Enum. Born. Pl. (1921) 337; Enum. Philip. Fl. Pl. 2 (1923) 427.

No. 1466, in open places. India to southern China and New Guinea.

Genus **CLAOXYLON** Jussieu

Claoxylon sp.

No. 1656, in forests. Perhaps belongs in the section *Borneensia,* but staminate flowers are necessary to determine its relationships. The infructescences are but about 1 cm long; fruits pubescent.

Genus **MELANOLEPIS** Reichenbach f. and Zollinger

Melanolepis multiglandulosa (Reinw.) Reichb. f. & Zoll.

Melanolepis multiglandulosa (Reinw.) Reichb. f. & Zoll.; MERR., Enum. Born. Pl. (1921) 340; Enum. Philip. Fl. Pl. 2 (1923) 431.

No. 1546, in open places. Indo-China through Malaysia to Java, New Guinea, and the Marianne Islands.

Genus **MALLOTUS** Loureiro

Mallotus lackeyi Elm.

Mallotus lackeyi Elm.; MERR., Enum. Philip. Fl. Pl. 2 (1923) 433.

No. 1681, in open forests. Leyte, Mindanao, Palawan, the Sulu Archipelago, and British North Borneo.

Mallotus leucocalyx Muell.-Arg.

Mallotus leucocalyx Muell.-Arg.; MERR., Enum. Philip. Fl. Pl. 2 (1923) 434.

No. 1516, in open places. Malay Peninsula, Philippines, Celebes, but not recorded from Borneo proper.

Mallotus miquelianus (Scheff.) Boerl.

Mallotus miquelianus (Scheff.) Boerl.; MERR., Enum. Born. Pl. (1921) 339; Enum. Philip. Fl. Pl. 2 (1923) 434.

No. 1533, in forests. Malay Peninsula, Sumatra, Borneo, and Palawan and Mindoro in the Philippines.

Mallotus ricinoides (Pers.) Muell.-Arg.

Mallotus ricinoides (Pers.) Muell.-Arg.; MERR., Enum. Born. Pl. (1921) 340; Enum. Philip. Fl. Pl. 2 (1923) 436.

No. 1393, in open forests. Tenasserim through Malaysia to tropical Australia.

Mallotus tiliifolius (Blume) Muell.-Arg.

Mallotus tiliifolius (Blume) Muell.-Arg.; MERR., Enum. Born. Pl. (1921) 340; Enum. Philip. Fl. Pl. 2 (1923) 436.

No. 1357, in open forests at low altitudes. Near the sea. Formosa to Sumatra, through Malaysia to tropical Australia and Samoa.

Genus **WETRIA** Baillon

Wetria macrophylla (Blume) J. J. Sm.

Wetria macrophylla (Blume) J. J. Sm.; MERR., Enum. Born. Pl. (1921) 341; Enum. Philip. Fl. Pl. 2 (1923) 437.

No. 1124, in forests. Sumatra and Java, through Borneo to the Philippines (Bancalan, Negros, Luzon).

Genus **MACARANGA** Thouars

Macaranga pearsonii sp. nov. § *Giganteæ.*

Arbor circiter 6 m alta, ramis ramulisque glabris, pruinosis, ramis plerumque cavis, ramulis 4 ad 5 mm diametro; foliis longe petiolatis (petiolo 8 ad 26 cm longo, glabro), profunde 3-lobatis, chartaceis, 15 ad 28 cm longis latisque, basi profunde cordatis, haud vel anguste peltatis, palmatinerviis, supra glabris vel nervis plus minusve ferrugineo-tomentosis, in siccitate pallide olivaceis, subtus pallidioribus, granulari-glandulosis, ad costa nervisque leviter pilosis, lobis acuminatis, margine integris vel distanter calloso-denticulatis; stipulis late ovatis, 7 ad 10 mm longis, glabris, patulis vel adscendentibus, deciduis; infructescentiis axillaribus, paniculatis, pyramidatis, 11 ad 16 cm longis, ferrugineo-hirsutis; bracteis pubescentibus, laciniatis, circiter 5 mm longis; capsulis didymis, glandulosis, inermis, circiter 4 mm longis, 5 mm latis.

BANGUEY ISLAND, *1672 P. Castro and F. Melegrito,* in forests, altitude about 50 meters, August, 1923.

A species clearly belonging in the section Giganteæ, and apparently distinct from the three species placed here by Pax and Hoffmann, as well as from the more numerous ones placed in the allied section Pruinosæ. The leaves vary greatly in size, but are always rather deeply cordate and only occasionally narrowly peltate, the petiole being inserted at most 1 cm from the

base. The species is dedicated to ex-Governor A. C. Pearson, C. M. G., of British North Borneo.

Macaranga tanarius (Linn.) Muell.-Arg.

Macaranga tanarius (Linn.) Muell.-Arg.; MERR., Enum. Born. Pl. (1921) 342; Enum. Philip. Fl. Pl. 2 (1923) 443.

Nos. 1346, 1580, in open forests. Andaman Islands to Formosa through Malaysia to tropical Australia. Both specimens cited represent the variety *tomentosa* Muell.-Arg.

Genus **ACALYPHA** Linnæus

Acalypha amentacea Roxb.

Acalypha amentacea Roxb.; MERR., Enum. Born. Pl. (1921) 343; Enum. Philip. Fl. Pl. 2 (1923) 444.

No. 1449, in open places. Throughout the Philippines, and extending to Java and New Guinea. I am not prepared to accept Pax and Hoffmann's reduction of Roxburgh's species to *Acalypha fruticosa* Forsk. without more evidence. The Banguey form is manifestly the same as the Philippine *Acalypha stipulacea* Klotz., which I have, rightly or wrongly, reduced to Roxburgh's species, the type of which was from the Moluccas.

Genus **RICINUS** Tournefort

Ricinus communis Linn.

Ricinus communis Linn.; MERR., Enum. Born. Pl. (1921) 344; Enum. Philip. Fl. Pl. 2 (1923) 447.

No. 1655, in open places. All warm countries, planted and naturalized.

Genus **JATROPHA** Linnæus

Jatropha curcas Linn.

Jatropha curcas Linn.; MERR., Enum. Born. Pl. (1921) 344; Enum. Philip. Fl. Pl. 2 (1923) 449.

No. 1553, in open places. Pantropic, a native of tropical America.

Genus **GALEARIA** Zollinger and Moritzi

Galearia dolichobotrys sp. nov. § *Eugalearia.*

Frutex circiter 3 m altus, ramis in siccitate pallide brunneis, lenticellatis, leviter pubescentibus, ramulis teretibus, pubescentibus, circiter 2.5 mm diametro; foliis chartaceis, in siccitate pallide viridis, nitidis, oblongis, 10 ad 16 cm longis, 4 ad 6 cm latis, supra glabra, subtus ad costa nervisque leviter pubes-

centibus, basi late rotundatis, plerumque leviter inaequilateralibus, subfalcato-acuminatis, nervis primariis utrinque circiter 8, subtus perspicuis, laxe arcuato-anastomosantibus; petiolo hirsuto, 5 ad 7 mm longo; inflorescentiis ♂ terminalibus, pendulis, multifloris, racemosis, usque ad 75 cm longis, subferrugineo-pubescentibus, bracteolis minutis, pubescentibus, vix 1 mm longis; floribus ♂ fasciculatis, numerosissimis, albidis, pedicellatis, pedicellis pubescentibus, 3 ad 4 mm longis; sepalis oblongo-lanceolatis, pubescentibus, 1.2 mm longis; petalis glaberrimis, cochleato-concavis, 1.5 mm longis, intus carinatis, apice leviter cucullatis, deorsum angustatis; antheris glabris, filamentis 0.5 ad 0.8 mm longis; ovario rudimenti subcylindrico, 1 mm longo, deorsum leviter angustato, apice leviter pubescenti.

BANGUEY ISLAND, *1377 P. Castro and F. Melegrito,* August 1, 1923, in primary forests at low altitudes.

The sixth species of the genus to be recorded from Borneo, belonging in the group with *Galearia phlebocarpa* Miq., well characterized by its very long staminate racemes. The petals are entirely glabrous.

Genus CODIAEUM (Rumphius) Jussieu

Codiaeum affine sp. nov.

Frutex monoicus, circiter 2 m altus, ut videtur vix ramosus, partibus junioribus inflorescentiisque leviter pubescentibus exceptis glaber, caulis teretibus, glabris, ramulis junioribus leviter adpresse hirsutis; foliis membranaceis vel subchartaceis, glaberrimis, anguste oblongis ad oblanceolatis, integris, 15 ad 25 cm longis, 4 ad 6 cm latis, basi obtusis ad acutis, apice acutis, in siccitate subolivaceis, nitidis, utrinque subconcoloribus; nervis primariis utrinque circiter 15, subpatulis, distantibus, perspicuis, arcuato-anastomosantibus, reticulis laxis; petiolo 5 ad 7 cm longo; inflorescentiis axillaribus, solitariis vel binis, racemosis, circiter 30 cm longis, leviter pubescentibus; floribus ♂ fasciculatis, albidis, pedicellis leviter pubescentibus, ad 8 mm longis; sepalis 5, concavis, orbiculari-ovatis, 4 ad 5 mm longis, extus leviter pubescentibus; staminibus circiter 50, filamentis 2 ad 2.5 mm longis, glabris: floribus ♀ breviter pedicellatis, haud fasciculatis, pedicellis crassis, circiter 1 mm longis; sepalis ovatis, acutis, pubescentibus, circiter 1.2 mm longis; ovario pubescenti, stylis tenuibus, 4 ad 5 mm longis, patulis, bifidis; capsulis junioribus adpresse pubescentibus, trilobatis, 6 mm diametro.

BANGUEY ISLAND, *1478 P. Castro and F. Melegrito,* August, 1923, near the seashore.

A species belonging in the Philippine group with *Codiaeum luzonicum* Merr. and *C. palawanense* Elm., having the bifid styles of the former, differing from it, among other characters, by its much fewer stamens, and by the presence, on at least some specimens, of a sessile, oblong-elliptic leaf up to 9 cm long and 4 cm wide subtending the racemes. In the latter character the present species resembles *Codiaeum palawanense* Elm., which, however, has very much larger leaves. No representative of this Philippine group of seven species has hitherto been found outside of the Archipelago.

The racemes are sometimes solitary, but are apparently more commonly in pairs, in the axil of a modified deciduous leaf, the staminate inflorescence superposed over the pistillate one. Curiously, no representative of *Codiaeum* is recorded from Borneo proper although numerous cultivated forms of *C. variegatum* Blume certainly occur there.

Genus **OSTODES** Blume

Ostodes macrophyllus (Muell.-Arg.) Benth. & Hook. f.

Ostodes macrophyllus (Muell.-Arg.) Benth. & Hook. f.; MERR., Enum. Born. Pl. (1921) 345; Enum. Philip. Fl. Pl. 2 (1923) 454.

No. 1671, in forests. Malay Peninsula and Borneo to Luzon, Sibuyan, and Panay in the Philippines.

Genus **CHAETOCARPUS** Thwaites

Chaetocarpus castanocarpus (Roxb.) Thwaites.

Chaetocarpus castanocarpus (Roxb.) Thwaites; MERR., Enum. Born. Pl. (1921) 346.

No. 1727, from Balambangan Island, in thickets or forests. India and Ceylon to the Malay Peninsula and Borneo; the genus has no known representative in the Philippines.

Genus **OMPHALEA** Linnæus

Omphalea sargentii Merr.

Omphalea sargentii MERR. in Philip. Journ. Sci. 16 (1920) 574; Enum. Philip. Fl. Pl. 2 (1923) 458.

No. 1373, in primary forests. British North Borneo and Bancalan Island in the Philippine group, the latter across Balabac Strait from Banguey Island.

Genus **HOMALANTHUS** Jussieu

Homalanthus populneus (Geisel.) Pax.

Homalanthus populneus (Geisel.) Pax; MERR., Enum. Born. Pl. (1921) 347; Enum. Philip. Fl. Pl. 2 (1923) 460.

No. 1561, in open places. Malay Peninsula through Malaysia to the Philippines and New Guinea.

Genus **EXCOECARIA** Linnæus

Excoecaria macrophylla J. J. Sm.?

Excoecaria macrophylla J. J. Sm.?; MERR., Enum. Born. Pl. (1921) 347; Enum. Philip. Fl. Pl. 2 (1923) 458.

No. 1615, in forests. The specimen is in fruit and differs from Smith's species, notably in its leaf venation. It may not belong in this genus.

Excoecaria sp.

No. 1371, along streams at sea level, the specimen in fruit. Probably belonging in the group with *Excoecaria agallocha* Linn., but certainly not that species. It is also represented by *No. 1817 D. D. Wood,* a sterile specimen from Ulo Klias, British North Borneo.

Genus **EUPHORBIA** Linnæus

Euphorbia hirta Linn.

Euphorbia hirta Linn.; MERR., Enum. Born. Pl. (1921) 348; Enum. Philip. Fl. Pl. 2 (1923) 462.

No. 1702, in open places. A pantropic weed.

Euphorbia atoto Forst. f.

Euphorbia atoto Forst. f.; MERR., Enum. Born. Pl. (1921) 348; Enum. Philip. Fl. Pl. 2 (1923) 461.

No. 1427, along the seashore. A characteristic strand plant of the Indo-Malaysian and Polynesian regions.

ANACARDIACEÆ

Genus **BUCHANANIA** Sprengel

Buchanania arborescens (Blume) Blume.

Buchanania arborescens (Blume) Blume; MERR., Enum. Born. Pl. (1921) 348; Enum. Philip. Fl. Pl. 2 (1923) 465.

Nos. 1444, 1562, in open places. Burma through Malaysia to the Philippines and Celebes.

Genus **MANGIFERA** Linnæus

Mangifera caesia Jack.

Mangifera caesia Jack; MERR., Enum. Born. Pl. (1921) 349; Enum. Philip. Fl. Pl. 2 (1923) 468.

No. 1693, in open places. Possibly planted as it is in some other parts of Malaysia. The Malay Peninsula to Java and the Philippines (Sulu Archipelago, Basilan, and Mindanao).

HIPPOCRATEACEÆ

Genus **SALACIA** Linnæus

Salacia prinoides (Willd.) DC.

Salacia prinoides (Willd.) DC.; MERR., Enum. Born. Pl. (1921) 355; Enum. Philip. Fl. Pl. 2 (1923) 487.

No. 1468, along the seashore. India through Malaysia to tropical Australia.

SAPINDACEÆ

Genus **ALLOPHYLUS** Linnæus

Allophylus timorensis (DC.) Blume.

Allophylus timorensis (DC.) Blume; MERR., Enum. Born. Pl. (1921) 357; Enum. Philip. Fl. Pl. 2 (1923) 497.

No. 1722, near the seashore, det. Radlkofer. Borneo to the Philippines, tropical Australia, New Hebrides, and the Marshall Islands.

Allophylus glaber (Roxb.) Radlk.

Allophylus glaber (Roxb.) Radlk.; RADLK. in Sitz. Kgl. Bayer. Akad. Wissensch. 38[2] (1908) 229.

No. 1662, near the seashore, det. Radlkofer. India and Burma to the Sunda Islands, hitherto not definitely recorded from Borneo.

Genus **OTOPHORA** Blume

Otophora fruticosa (Roxb.) Blume.

Otophora fruticosa (Roxb.) Blume; MERR., Enum. Born. Pl. (1921) 358; Enum. Philip. Fl. Pl. 2 (1923) 500.

No. 1577, in open places. Siam through Malaysia to the Philippines and the Moluccas.

Genus **EUPHORIA** Commerson

Euphoria sp. nov. *fide* Radlk.

No. 1650, in forests near the seashore, by me identified as the Philippine *Euphoria gracilis* Radlk., and the duplicates so distributed.

Genus **POMETIA** Forster

Pometia pinnata Forst.

Pometia pinnata Forst.; MERR., Enum. Born. Pl. (1921) 361; Enum. Philip. Fl. Pl. 2 (1923) 505.

No. 1422, in forests. Malay Peninsula and Archipelago to New Guinea and Polynesia.

Genus **ARYTERA** Blume

Arytera litoralis Blume.

Arytera litoralis Blume; MERR., Enum. Born. Pl. (1921) 361; Enum. Philip. Fl. Pl. 2 (1923) 512.

No. 1623, near the seashore. Burma to southern China through Malaysia to New Guinea.

Genus **MISCHOCARPUS** Blume

Mischocarpus sundaicus Blume.

Mischocarpus sundaicus Blume; MERR., Enum. Philip. Fl. Pl. 2 (1923) 513.

No. 1736, from Balambangan Island, on slopes. Malay Peninsula to southern China through Malaysia to tropical Australia, although not definitely recorded from Borneo proper.

Genus **PARANEPHELIUM** Blume

Paranephelium nitidum King.

Paranephelium nitidum KING in Journ. As. Soc. Bengal 65 [2] (1896) 450 (Mat. Fl. Mal. Penin. 2: 736); RIDL. Fl. Mal. Penin. 1 (1922) 509.

Nos. 1564, 1757, the latter from Balambangan Island, in forests. Malay Peninsula.

No representative of the genus is recorded from either Borneo or the Philippines. The specimens, examined by Mr. Ridley, are reported on from Kew as follows: "*Paranephelium nitidum* or very near it. The main difference from the example in the herbarium from the Malay Peninsula is that in the latter the apex of the fruit is umbonate, whereas in Mr. Merrill's specimen the apex is depressed." Doctor Radlkofer verifies this identification for both specimens cited.

Genus **DODONAEA** Linnæus

Dodonaea viscosa (Linn.) Jacq.

Dodonaea viscosa (Linn.) Jacq.; MERR., Enum. Born. Pl. (1921) 362; Enum. Philip. Fl. Pl. 2 (1923) 514.

No. 1747, from Balambangan Island, along the seashore. A pantropic strand plant, in some regions occurring far inland.

RHAMNACEÆ

Genus ZIZYPHUS Tournefort

Zizyphus inermis Merr.

Zizyphus inermis MERR. in Govt. Lab. Publ. (Philip.) 35 (1906) 37; Enum. Philip. Fl. Pl. 2 (1923) 522.

No. 1408, in forests. Throughout the Philippines, also in Celebes, but otherwise not known from outside the Philippine group.

Genus COLUBRINA L. C. Richard

Colubrina asiatica (Linn.) Brongn.

Colubrina asiatica (Linn.) Brongn.; MERR., Enum. Philip. Fl. Pl. 2 (1923) 525.

No. 1581, in open forest at sea level. Old World Tropics from Africa to Polynesia, but not definitely recorded from Borneo proper, although certainly occurring there.

VITACEÆ

Genus TETRASTIGMA Planchon

Tetrastigma loheri Gagnep.

Tetrastigma loheri GAGNEP. in Not. Syst. 1 (1910) 265, 323; MERR., Enum. Philip. Fl. Pl. 3 (1923) 4.

No. 1120. Luzon to Palawan and Mindanao in the Philippines, but otherwise not recorded from outside the limits of the Archipelago.

Tetrastigma trifoliolatum Merr.

Tetrastigma trifoliolatum MERR., Enum. Born. Pl. (1921) 367; Enum. Philip. Fl. Pl. 3 (1923) 5.

No. 1538, in open places. Leyte and Samar in the Philippines, and in British North Borneo.

Tetrastigma sp.

No. 1603, rather scanty fruiting material, a form with distinctly large fruits, and 3- or 5-foliolate leaves; flowering material desirable.

Genus AMPELOCISSUS Planchon

Ampelocissus sp.

No. 1501, in forests. A species in general aspect resembling *Ampelocissus arachnoidea* Planch. and *A. martini* Planch., but nearly glabrous. The specimen has immature fruits; additional material is essential to its proper identification.

Genus CISSUS Linnæus

Cissus nodosa Blume.

Cissus nodosa Blume; MERR., Enum. Born. Pl. (1921) 367.

No. 1421, near the seashore. Borneo and Java.

Genus COLUMELLA Loureiro

Columella pterita Merr.

Columella pterita MERR. in Philip. Journ. Sci. 11 (1916) Bot. 134; Enum. Philip. Fl. Pl. 3 (1923) 9.

No. 1632, near the seashore. Previously recorded from Panay and from the Sulu Archipelago in the Philippines.

Genus LEEA Linnæus

Leea aculeata Blume.

Leea aculeata Blume; MERR., Enum. Born. Pl. (1921) 368; Enum. Philip. Fl. Pl. 3 (1923) 10.

No. 1617, in forests. Java and Borneo to the Philippines and the Moluccas.

Leea indica (Burm. f.) Merr.

Leea indica (Burm. f.) MERR., Enum. Born. Pl. (1921) 362; Enum. Philip. Fl. Pl. 3 (1923) 11.

No. 1778, from Balambangan Island, near swamps. Widely distributed in the Indo-Malaysian region, more commonly known as *Leea sambucina* Willd.

Leea negrosensis Elm.

Leea negrosensis ELM., Leafl. Philip. Bot. 2 (1908) 494; MERR., Enum. Philip. Fl. Pl. 3 (1923) 13.

No. 1510, in open places. Widely distributed in the Philippines, extending from northern Luzon to Mindanao, but hitherto not known from outside the Archipelago.

ELAEOCARPACEÆ

Genus ELAEOCARPUS Linnæus

Elaeocarpus cumingii Turcz.

Elaeocarpus cumingii Turcz.; MERR., Enum. Philip. Fl. Pl. 3 (1923) 15.

No. 1380, in primary forests. The specimen is in fruit and appears safely to be the same as the Palawan *Elaeocarpus versicolor* Elm., which I have reduced to *E. cumingii* Turcz. Throughout the Philippines.

Elaeocarpus sp.

No. 1739, from Balambangan Island, in forests. A species somewhat resembling the Philippine *Elaeocarpus elmeri* Aug. DC., but safely not referable to it. There are only very young buds available.

GONYSTYLACEÆ

Genus **GONYSTYLUS** Teysmann and Binnendyck

Gonystylus sp.

No. 1684, in forests. Possibly representing *Gonystylus bancanus* (Miq.) Gilg, which occurs in Sumatra, Bangka, Java, and the Philippines. A fruiting specimen.

TILIACEÆ

Genus **GREWIA** Linnæus

Grewia acuminata Juss.

Grewia acuminata Juss.; MERR., Enum. Born. Pl. (1921) 373; Enum. Philip. Fl. Pl. 3 (1923) 24.

No. 1635, near the seashore. Malay Peninsula to the Philippines and the Moluccas.

Grewia stylocarpa Warb. var. **longipetiolata** Merr.

Grewia stylocarpa Warb. var. *longipetiolata* MERR., Enum. Born. Pl. (1921) 373.

No. 1515, in forests. The species common throughout the Philippines, the variety in British North Borneo. Closely allied to *Grewia antidesmaefolia* King of the Malay Peninsula.

Genus **COLUMBIA** Persoon

Columbia borneensis Merr.

Columbia borneensis MERR., Enum. Born. Pl. (1921) 373.

No. 1619, in forests. British North Borneo.

MALVACEÆ

Genus **SIDA** Linnæus

Sida retusa Linn.

Sida retusa Linn.; MERR., Enum. Philip. Fl. Pl. 3 (1923) 35.

No. 1526, in open places; not recorded from Borneo proper but certainly occurring there. India to Malaysia.

Sida rhombifolia Linn.

Sida rhombifolia Linn.; MERR., Enum. Born. Pl. (1921) 374; Enum. Philip. Fl. Pl. 3 (1923) 35.

No. 1520, in open places. A pantropic weed.

Genus **URENA** Dillenius

Urena lobata Linn.

Urena lobata Linn.; MERR., Enum. Born. Pl. (1921) 374; Enum. Philip. Fl. Pl. 3 (1923) 36.

No. 1350, in open places. Pantropic.

Genus **HIBISCUS** Linnæus

Hibiscus tiliaceus Linn.

Hibiscus tiliaceus Linn.; MERR., Enum. Born. Pl. (1921) 375; Enum. Philip. Fl. Pl. 3 (1923) 39.

Nos. 1567, 1760, along the seashore. A pantropic strand plant.

Genus **THESPESIA** Solander

Thespesia populnea (Linn.) Soland.

Thespesia populnea (Linn.) Soland.; MERR., Enum. Born. Pl. (1921) 375; Enum. Philip. Fl. Pl. 3 (1923) 42.

No. 1627, along the seashore. A pantropic strand plant.

BOMBACACEÆ

Genus **DURIO** Adanson

Durio acuminatissimus sp. nov.

Arbor circiter 6 m alta, ramulis teretibus, circiter 3 mm diametro, dense adpresse lepidotis; foliis membranaceis, oblongis, 14 ad 22 cm longis, 5 ad 7 cm latis, basi rotundatis ad latissime acutis, apice abrupte subcaudato-acuminatis, acuminis tenuibus, acutis vel subobtusis, 1 ad 2 cm longis, in siccitate supra pallide olivaceis, nitidis, glabris, subtus densissime adpresse argenteo-lepidotis; nervis primariis utrinque circiter 15, tenuibus, distinctis, subpatulis, arcuato-anastomosantibus; petiolo 1.5 ad 2 cm longo, dense lepidoto; floribus ignotis; fructibus ellipsoideis ad subovoideis, utrinque rotundatis, circiter 16 cm longis et 11 cm diametro, 5-locularis, $\frac{1}{2}$ ad $\frac{2}{3}$ dehiscens, valvis duris, intus glabris, extus dense muricatis, spinis numerosis rigidis, 6 ad 16 mm longis, basi circiter 5 mm crassis, dense lepidotis, rectis vel leviter curvatis, obscurissime angulatis; seminibus ignotis.

BANGUEY ISLAND, *1570 P. Castro and F. Melegrito,* July 30, 1923, in open places at low altitudes.

A species well characterized by its slenderly and abruptly subcaudate-acuminate, membranaceous leaves, its ellipsoid to subovoid fruits which are rounded at both ends, and by its relatively slender, very numerous spines, each valve bearing between 200 and 300 straight or somewhat curved, rigid spines

which attain a maximum length of 16 mm and are about 5 mm in diameter at the base. The species is apparently most closely allied to *Durio carinatus* Mast.

STERCULIACEÆ

Genus KLEINHOFIA Linnæus

Kleinhofia hospita Linn.

Kleinhofia hospita Linn.; MERR., Enum. Born. Pl. (1921) 379; Enum. Philip. Fl. Pl. 3 (1923) 52.

No. 1622, in open places. India to tropical Africa and Malaysia.

Genus STERCULIA Linnæus

Sterculia pearsonii sp. nov.

Arbor circiter 5 m alta, ramulis circiter 8 mm diametro, dense ferrugineo- vel castaneo-pubescentibus, stipulis numerosis, persistentibus, lanceolatis, in siccitate brunneis, extus leviter pubescentibus, 4 ad 5 cm longis, circiter 8 mm latis, acuminatis; foliis oblanceolatis, chartaceis, 40 ad 55 cm longis, 11 ad 12 cm latis, in siccitate pallide viridibus, supra costa dense ferrugineo-pubescens excepta glabris, subtus ad costa nervisque leviter stellato-tomentosis, apice subcaudato-acuminatis, deorsum longe angustatis, basi 1.5 cm latis, abrupte subcordato-rotundatis; nervis lateralibus utrinque circiter 16, curvato-arcuatis, perspicuis; petiolo crasso, dense castaneo-pubescenti, circiter 1 cm longo; paniculis terminalibus, multifloris, circiter 15 cm longis, dense castaneo-pubescentibus, ramis primariis circiter 5 cm longis; floribus 1.2 ad 1.5 cm longis, extus dense castaneo-pubescentibus, tubo circiter 8 mm longo, lobis 5, arcuato-cohaerentibus, intus pallide villosis, oblongo-lanceolatis, circiter 3 mm latis; ovario ellipsoideo, dense pubescenti, stylis villosis, 3 mm longis, lobis 5, glabris vel subglabris, valde recurvatis, stylo aequantibus; antheris 10, sessilibus, 1.2 mm longis.

BANGUEY ISLAND, *1669 P. Castro and F. Melegrito*, August, 1923, in forests at low altitudes; flowers yellow.

A species in general appearance rather closely approximating the Philippine *Sterculia jagori* Warb., but with entirely different flowers, the calyx lobes being oblong-lanceolate, as long as the tube, arcuate and cohering by their tips. It differs from *Sterculia trichopetiolata* Merr. by similar characters, as well as by its indumentum. It is manifestly remote from *Sterculia stipu-*

lata Korth., having much larger, very differently shaped leaves. The species is dedicated to Ex-Governor A. C. Pearson, C. M. G., of British North Borneo.

Sterculia castroi sp. nov.

Arbor circiter 13 m alta, inflorescentiis plus minusve stellato-pubescentibus exceptis glabra, ramis teretibus, pallidis, ultimis 4 ad 5 mm diametro; foliis chartaceis, oblongo-ovatis ad ellipticis, integris, in siccitate pallide olivaceis vel brunneo-olivaceis, utrinque nitidis, glaberrimis, 14 ad 22 cm longis, 6 ad 11 cm latis, basi rotundatis subtrinerviis, apice latissime et breviter obtuse acuminatis vel subobtusis, nervis primariis utrinque circiter 10, perspicuis, distantibus, patule-curvatis, anastomosantibus; petiolo 5 ad 8 cm longo; inflorescentiis paniculatis, axillaribus, usque ad 15 cm longis, leviter stellato-tomentosis, indumento ferrugineo, ramis primariis paucis, patulis, ad 5 cm longis; floribus tenuiter (ad 5 mm) pedicellatis, circiter 7.5 mm longis, extus leviter stellato-pubescentibus, pallide flavidis, tubo cupulato, circiter 4 mm longo, lobis 5, suberectis, haud cohaerentibus, oblongo-lanceolatis, subacuminatis, tubo aequantibus; ovario depresso-globoso, dense pallide pubescenti, circiter 2 mm diametro, stylis villosis, crassis, vix 1 mm longis, lobis 4 vel 5, patulis, glabris, obovatis, vix 1 mm longis.

BANGUEY ISLAND, *1483 P. Castro and F. Melegrito,* August, 1923, near the seashore.

A species well characterized by being entirely glabrous except for the sparse, rather scattered, stellate, pale ferruginous indumentum on the inflorescences as well as by its long-petioled leaves.

Genus HERITIERA Dryander

Heritiera littoralis Dryand.

Heritiera littoralis Dryand.; MERR., Enum. Born. Pl. (1921) 381; Enum. Philip. Fl. Pl. 3 (1923) 58.

No. 1368, within the influence of salt water. Along the seashore, tropical Africa and Asia, through Malaysia to western Polynesia.

DILLENIACEÆ

Genus TETRACERA Linnæus

Tetracera scandens (Linn.) Merr.

Tetracera scandens (Linn.) MERR., Enum. Born. Pl. (1921) 382; Enum. Philip. Fl. Pl. 3 (1923) 59.

No. 1507, in open places. India to southern China and Malaysia.

Genus **WORMIA** Rottboell

Wormia subsessilis Miq.

Wormia subsessilis MIQ., Fl. Ind. Bat. Suppl. (1860) 619; Ann. Mus. Bot. Lugd.-Bat. 4 (1868–1869) 77; RIDL., Fl. Mal. Penin. 1 (1922) 7, *fig. 2.*

No. 1502, near the seashore. Malay Peninsula, Bangka, and Borneo.

This is the species recorded by me from Borneo as *Dillenia suffruticosa* (Griff.) Martelli,[7] but Ridley considers that *Wormia suffruticosa* Griff. (*Dillenia suffruticosa* Martelli) is specifically distinct from *Wormia subsessilis* Miq. *Wormia burbidgei* Hook. f. is manifestly the same as *W. subsessilis* Miq. The species has not been found in the Philippines.

Wormia sp.

No. 1719, in forests at low altitudes. The material is insufficient. It possibly is referable to *Wormia oblonga* Wall., a species of the Malay Peninsula and Sumatra.

Genus **SAURAUIA** Willdenow

Saurauia melegritoi sp. nov.

Frutex circiter 3 m altus, glaber; ramis teretibus, circiter 5 mm diametro, castaneis, parcissime adpresse squamulosis, squamulis sublanceolatis, pallidis, 1 ad 2 mm longis; foliis submembranaceis ad chartaceis, oblongo-obovatis ad obovatis, 20 ad 30 cm longis, 9 ad 14 cm latis, supra glaberrimis, olivaceis ad atro-olivaceis, subtus pallidis, glabris vel costa nervisque squamulis paucis adpressis instructis, margine distanter serratis, apice abrupte acute-acuminatis, acuminis subrostratis, circiter 1 cm longis, basi acutis vel cuneatis, nervis primariis utrinque circiter 12 perspicuis, curvato-adscendentibus, arcuato-anastomosantibus; petiolo 3.5 ad 6 cm longo, glabro vel parcissime adpresse squamuloso; floribus axillaribus, fasciculatis, pedicellis leviter squamulosis, usque ad 1 cm longis, sepalis suborbicularibus, rotundatis, glabris vel margine leviter ciliatis, 5 ad 6 mm diametro; petalis quam sepalis paullo longioribus; staminibus 20, filamentis glabris, 3 mm longis, antheris oblongis, curvatis, 2 mm longis; ovario plus minusve villoso, globoso; stylis 3, liberis, 4 mm longis.

[7] Enum. Born. Pl. (1921) 384.

BANGUEY ISLAND, *1401 P. Castro and F. Melegrito,* June 8, 1923, in primary forests at low altitudes. The same species is also represented by *No. 1770 D. D. Wood, coll. J. Agama* from an old clearing, Balambangan Island.

A species belonging in the group with *Saurauia tristyla* DC., but with much larger, differently shaped leaves, the ovaries pubescent, not glabrous. It differs from *Saurauia amplifolia* Merr. in its shorter, differently shaped, fewer-nerved leaves as well as in its axillary, few-flowered fascicles.

OCHNACEÆ

Genus **EUTHEMIS** Jack

Euthemis leucocarpa Jack.

Euthemis leucocarpa Jack; MERR., Enum. Born. Pl. (1921) 388.

No. 1771, from Balambangan Island, in forests. Malay Peninsula, Lingga, Bangka, and Borneo; no representative of the genus is known from the Philippines.

GUTTIFERÆ

Genus **CRATOXYLON** Blume

Cratoxylon cochinchinense (Lour.) Blume.

Cratoxylon cochinchinense (Lour.) Blume; MERR., Enum. Philip. Fl. Pl. 3 (1923) 77.

Cratoxylon formosum (Jack) Dyer; MERR., Enum. Born. Pl. (1921) 392.

No. 1668, in forests at low altitudes. Indo-China and the Malay Peninsula to Java, the Moluccas, and the Philippines.

Cratoxylon ligustrinum (Spach) Blume.

Cratoxylon ligustrinum (Spach) Blume; MERR., Enum. Philip. Fl. Pl. 3 (1923) 77.

Cratoxylon polyanthum Korth.; MERR., Enum. Born. Pl. (1921) 395.

No. 1352, in open forests. Burma to southeastern China, the Malay Peninsula, Sumatra, Borneo, and Palawan and the Calamian group in the Philippines, but not in the Philippine Archipelago proper.

In the case of both species enumerated here what is apparently the oldest valid name for each is adopted.

Genus **CALOPHYLLUM** Linnæus

Calophyllum inophyllum Linn.

Calophyllum inophyllum Linn.; MERR., Enum. Born. Pl. (1921) 393; Enum. Philip. Fl. Pl. 3 (1923) 79.

No. 1644, along the seashore. A characteristic tropical strand tree extending from East Africa to eastern Polynesia.

Genus OCHROCARPUS Thouars

Ochrocarpus ovalifolius T. Anders.

Ochrocarpus ovalifolius T. ANDERS. ex Hemsl. in Bot. Challenger Exped. (1885) 122, 234; KOORD. & VAL., Bijdr. Boomsoort. Java 9 (1903) 391.

Calysaccion ovalifolium CHOISY, Guttif. Ind. (1850) 46.

No. 1452, along the seashore. Java, Timor, New Guinea, Key Islands, Borneo *fide* Koorders and Valeton l. c., Admiralty Islands, and Fiji. Not known from the Philippines unless *Ochrocarpus ramiflorus* Merr. proves to be the same; the latter is apparently nearer *O. siamensis* T. Anders. Presumably *O. horstii* Teysm. & Binn., from Borneo, belongs here, but I have been unable to locate any description of it.

Genus GARCINIA Linnæus

Garcinia benthami Pierre.

Garcinia benthami Pierre; MERR., Enum. Born. Pl. (1921) 395; Enum. Philip. Fl. Pl. 3 (1923) 83.

No. 1495, along the seashore. Indo-China, British North Borneo, Balabac, and Palawan. The specimen cited above is in fruit, so that the identification is not entirely certain.

Garcinia sp.

No. 1720, in open places. A very fragmentary specimen with immature fruits.

DIPTEROCARPACEÆ

Genus DIPTEROCARPUS Gaertner f.

Dipterocarpus caudiferus sp. nov. § *Sphaerales.*

Arbor circiter 18 m alta, subglabra, ramulis tenuibus, teretibus, circiter 2 mm diametro, gemmis linearis, 2 cm longis, 1.5 ad 2 mm diametro, densissime adpresse fulvo-hirsutis; foliis oblongis ad late oblongo-oblanceolatis, circiter 14 cm longis, 7 ad 9 cm latis, chartaceis, margine in $\frac{1}{4}$ superiore parte leviter undulatis, apice abrupte longissime tenuiter caudato-acuminatis, acuminis 3.5 ad 4.5 cm longis, basi leviter angustatis, obtusis, supra in siccitate olivaceis, subnitidis, glabris, subtus paullo pallidioribus, ad costa nervisque leviter adpresse hirsutis; nervis

primariis utrinque circiter 18, perspicuis; petiolo 1.5 cm longo, glabro vel parce stellato-tomentoso; floribus ignotis; fructibus ovoideis ad subglobosis, 2.5 ad 3 cm diametro, 3 cm longis, laevis, brunneis, glabris, alis majoribus 13 ad 20 cm longis, 2.5 ad 3 cm latis, anguste oblongis ad oblanceolatis, crasse coriaceis, nitidis, apice rotundatis, distincte 3-nervis, reticulatis, alis minoribus brevissimus, vix 4 mm longis.

BANGUEY ISLAND, *1709 P. Castro and F. Melegrito,* in primary forests at low altitudes.

A very strongly characterized species, readily recognizable by its abruptly long and very slenderly caudate-acuminate leaves, in this character resembling the Philippine *Dipterocarpus caudatus* Foxw.; it is not closely allied to Foxworthy's species, differing markedly in vegetative and fruit characters.

Dipterocarpus woodii sp. nov. § *Sphaerales.*

Arbor circiter 15 m alta, gemmis (stipulis) dense fulvo-hirsutis vel ciliatis exceptis glabra vel subglabra, ramulis glaberrimis, castaneis, teretibus vel subcompressis, cicatricibus perspicuis instructis; foliis coriaceis, oblongis, 14 ad 25 cm longis, 6 ad 10 cm latis, utrinque glabris, vel junioribus subtus ad costa nervisque plus minusve longe adpresse hirsutis vel ciliatis, margine leviter undulatis, basi rotundatis, apice breviter abrupteque acuminatis; nervis primariis utrinque 23 ad 30, rectis, parallelis, valde perspicuis, inter nervis primariis obscure subplicatis, in siccitate olivaceo-brunneis, nitidis, subtus pallidioribus; petiolo glabro, circiter 5 cm longo; stipulis densissime longe fulvo-hirsutis vel ciliatis, usque ad 11 cm longis, deciduis; infructescentiis axillaribus, glabris, vix ramosis, usque ad 14 cm longis, internodiis 1.5 ad 2.5 cm longis, perspicue "zig-zag;" fructibus junioribus (calycis tubo) glabris, 2.5 cm longis, 1.5 cm diametro, cupulatis vel ovoideis, basi acutis vel rotundatis, cylindraceis, laevis, alis majoribus glabris, anguste oblongis, circiter 11 cm longis, usque ad 2 cm latis (immaturis), apice rotundatis, basi leviter angustatis, 3-nervis, leviter reticulatis, coriaceis, alis minoribus late ovatis ad reniformibus, rotundatis, vix 4 mm longis, nucis junioribus apice densissime fulvo-hirsutis.

BANGUEY ISLAND, *1404 P. Castro and F. Melegrito,* June 8, 1923, in primary forests.

A species belonging in the general group with *Dipterocarpus retusus* Blume, but not closely allied to that species. Among

the described forms possibly most closely allied to the Philippine *Dipterocarpus lasiopodus* Perk., although radically different from the latter.

VIOLACEÆ

Genus **RINOREA** Aublet

Rinorea glandulosa (Elm.) Merr.

Rinorea glandulosa (Elm.) MERR. in Philip. Journ. Sci. 12 (1917) Bot. 286; Enum. Philip. Fl. Pl. 3 (1923) 104.

No. 1613, in forests at low altitudes. Luzon, Mindoro, Palawan, Sibuyan, and Panay in the Philippines, but hitherto not known from outside the Archipelago.

Rinorea hirtella (Ridl.) comb. nov.

Alsodeia hirtella RIDL. in Kew Bull. (1914) 377; Fl. Mal. Penin. 1 (1922) 128.

Penang and Borneo.

Rinorea castilloi Merr.

Rinorea castilloi MERR. in Philip. Journ. Sci. 21 (1922) 530.

No. 1535, July 28, 1923, in forests at low altitudes. British North Borneo, Tawitawi, and Jolo.

The specimen is in fruit, and as far as the material is directly comparable it agrees intimately with the type of *Rinorea castilloi* Merr., which was from British North Borneo. Three collections, all in fruit, have recently been received from the Sulu Archipelago, representing the same species. A specimen of the collection cited above was sent to Kew for comparison and Mr. Ridley reported it as "*Alsodeia,* very near *A. hirtella* Ridl., but with glabrous leaves, otherwise identical." This probably indicates the true alliance of *Rinorea castilloi* Merr.

FLACOURTIACEÆ

Genus **PANGIUM** Reinwardt

Pangium edule Reinw.

Pangium edule Reinw.; MERR., Enum. Born. Pl. (1921) 411; Enum. Philip. Fl. Pl. 3 (1923) 108.

No. 1120, along Pankulan River. Widely distributed in the Malay Peninsula and Archipelago.

Genus **RYPAROSA** Blume

Ryparosa oligophlebia Merr.

Ryparosa oligophlebia MERR., Enum. Born. Pl. (1921) 411.

No. 1374, in forests. Borneo.

Ryparosa borneensis Van Slooten, Bijdr. Kenn. Combr. Flac. Nederl.-Ind. (1919) 88, is a synonym, *R. oligophlebia* Merr. having been published one year earlier.

Genus **HOMALIUM** Jacquin

Homalium foetidum (Wall.) Benth.

Homalium foetidum (Wall.) Benth. in Journ. Linn. Soc. Bot. 4 (1860) 37.

Blackwellia foetida Wall., Cat. No. 4899; A. DC. in Delessert Ic. Select. Plant. 3 (1837) 32, *t. 53.*

Nos. 1440, 1525, in forests. Both specimens agree closely with the descriptions and with Delessert's plate. Celebes, Ceram, Amboina, Halmahera, and New Guinea; not known from Borneo proper or from the Philippines.

Genus **FLACOURTIA** L'Héritier

Flacourtia rukam Zoll. & Mor.

Flacourtia rukam Zoll. & Mor.; Merr., Enum. Born. Pl. (1921) 412; Enum. Philip. Fl. Pl. 3 (1923) 113.

No. 1406, in primary forests. Malay Peninsula to Hainan, through Malaysia to New Guinea.

Genus **CASEARIA** Jacquin

Casearia polyantha Merr.

Casearia polyantha Merr., Enum. Philip. Fl. Pl. 3 (1923) 116.

Nos. 1378, 1593, in forests. Throughout the Philippines, but other than this collection not known from outside the Philippine group.

Genus **TARAKTOGENOS** Hasskarl

Taraktogenos anomala sp. nov.

Arbor circiter 10 m alta, ramulis leviter ferrugineo-pubescentibus, ramis glabris; foliis chartaceis vel subcoriaceis, oblongis, in siccitate pallidis, 15 ad 22 cm longis, 6 ad 9 cm latis, integris, apice abrupte tenuiter subcaudato-acuminatis, basi subacutis ad subrotundatis, leviter inaequilateralibus, supra glabris, subtus ad costa nervisque leviter pubescentibus; nervis lateralibus utrinque 6 vel 7, subtus valde perspicuis, adscendentibus, petiolo 2 ad 3 cm longo; inflorescentiis ♂ axillaribus, solitariis, thyrsoideo-racemosis, 1 ad 4 cm longis, leviter pubescentibus; floribus albidis, circiter 2 cm diametro, pedicellis circiter basin articulatis, glabris vel leviter pubescentibus, usque

ad 3 cm longis; sepalis 7, chartaceis ad coriaceis, glabris vel subglabris, liberis, imbricatis, late ovatis, 10 ad 12 mm longis, rotundatis, exterioribus concavis; petalis 7, ellipticis ad oblongo-ellipticis vel obovatis, 10 ad 12 mm longis, rotundatis, extus densissime ferrugineo-villosis, intus glabris vel subglabris, intus ad basin squama crassa densissime hirsuta oblonga ad obovata rotundata vel truncata 4 ad 5 mm longa instructa; staminibus circiter 35, filamentis deorsum incrassatis, 6 ad 7 mm longis, ciliato-hirsutis; antheris 3 mm longis.

BANGUEY ISLAND, *1400 P. Castro and F. Melegrito,* August 6, 1923, in primary forests at low altitudes.

This species is anomalous in *Taraktogenos* in having isomerous sepals and petals, but it has been placed here, rather than in *Hydnocarpus*, on account of its numerous stamens. It apparently is allied to *Taraktogenos polypetala* Van Slooten,[8] from which, however, it differs in numerous characters, such as its longer, only slightly pubescent petioles; glabrous, not rufo-sericeous sepals; more numerous stamens; and isomerous (7) sepals and petals.

The following Sumatran species, in a closely allied genus, is here described:

Genus **HYDNOCARPUS** Gaertner

Hydnocarpus yatesii sp. nov.

Arbor circiter 8 m alta, partibus junioribus inflorescentiisque exceptis glabra, ramis teretibus, glabris, ramulis tenuibus, 1 ad 1.5 mm diametro, teretibus, in siccitate pallidis; foliis oblongis, chartaceis, nitidis, in siccitate pallidis, 12 ad 16 cm longis, 5 ad 7 cm latis, integerrimis, basi inaequilateralibus, acutis, apice tenuiter abrupteque acuminatis, supra glaberrimis, subtus ad costa nervisque parce pubescentibus glabrescentibus; nervis primariis utrinque 6 ad 8, curvato-adscendentibus, perspicuis; petiolo 8 ad 10 mm longo, pubescente; inflorescentiis ♂ axillaribus, solitariis, pedunculo circiter 5 mm longo, ramis 4 ad 6, umbellato-radiatim dispositis, rigidis, patulis vel curvatis, pubescentibus, cum bracteolis 2 mm diametro, circiter 5 mm longis; floribus ♂ deciduis, pedicellis prope basi articulatis, biseriatim dispositis, ramis subtus bracteolis late ovatis leviter pubescentibus obtusis dense imbricatis 1 mm longis biseriatim dispositis instructis; pedicellis circiter 3 mm longis; sepalis 5, extus pubescentibus, concavis, orbiculari-ovatis, 1.5 ad 2 mm diametro; petalis 5, suborbicularis, concavis, pubescentibus, rotundatis, 2

[8] Bijdr. Kenn. Combr. Flac. Nederl.-Ind. (1919) 74.

mm diametro, squamis late obovatis, dense pubescentibus, 1 mm longis; antheris vix 0.6 mm longis, circiter 1 mm latis, filamentis brevibus; fructibus subcylindraceis, circiter 11 cm longis et 5 cm diametro, apice obtusis et obscure 5-angulatis, glabris, in siccitate pallidis, pericarpio circiter 5 mm crasso; seminibus circiter 18, irregularis, 2 ad 2.5 cm longis.

SUMATRA, east coast, Asahan, Goerach Batoe, *H. S. Yates 1210*, November 16, 1924, in forests, altitude about 30 meters.

A species strongly characterized by its large, subcylindric, many-seeded fruits which are about 11 cm long and 5 mm in diameter, as well as by its peculiar staminate inflorescences and small anthers. The short axillary peduncles bear at their apices from 4 to 6 short, radiately disposed branches, the staminate flowers being densely arranged in two parallel rows along the upper side of each branch but, the pedicels being jointed near their bases, the flowers fall after anthesis, leaving the conspicuous persistent basal parts of the pedicels; on the lower side of each branch are two rows of persistent, small, densely imbricate bracteoles, giving these short usually curved branches a distinctly pectinate appearance. While each branch bears many flowers, only a few buds or flowers are present at any one time, as they fall immediately after anthesis, developing serially from the base as the branch increases in length, the actual buds and flowers being found only near the tips of the branches.

From its vegetative characters and the shape and size of its fruits it would seem that its alliance is with *Hydnocarpus cucurbitina* King of the Malay Peninsula, but King definitely described this as having but one or two seeds in each fruit.

BEGONIACEÆ

Genus **BEGONIA** Linnæus

Begonia borneensis A.DC.

Begonia borneensis A. DC.; MERR., Enum. Born. Pl. (1921) 414.

No. 1362, in primary forests. A species known only from Borneo.

Begonia subnummularifolia sp. nov. § *Diploclinium.*

Herba subglabra, caule repente, tenue, circiter 1.5 mm diametro, partibus junioribus parce longe ciliato, internodiis 1 ad 4 cm longis; stipulis 6 ad 10 mm longis, lanceolatis ad ovato-lanceolatis, longissime penicellato-acuminatis; foliis membranaceis, orbicularis vel suborbicularis, integris, apice aequaliter rotundatis, basi aequilateralibus, leviter cordatis, radiatim 7-

nerviis, 2.5 ad 5 cm diametro, margine breviter ciliatis, utrinque glabris vel ad nervis leviter ferrugineo-ciliatis; petiolo 2.5 ad 5 cm longo; inflorescentiis pedunculatis, foliis subaequantibus, paucifloris, bracteis ovatis ad elliptico-ovatis, 3 ad 3.5 mm longis; floribus ♂ albidis, circiter 1.5 cm diametro, sepalis glabris, ellipticis, 7 ad 8 mm longis, rotundatis; petalis sepalis subaequantibus, angustioribus, oblongo-obovatis; staminibus circiter 40, filamentis 0.5 ad 1 mm longis, antheris obovoideis quam filamentis paullo brevioribus; capsulis aequaliter 3-alatis, 6 mm longis, cum alis 9 ad 11 mm latis, glabris, in ambitu subrhomboideis, alis rotundatis.

BANGUEY ISLAND, *1545 P. Castro and F. Melegrito*, September, 1923, on forested slopes, altitude about 150 meters.

A species well characterized by its slender, prostrate, nearly glabrous, elongated stems and especially by its equilateral, entire, rounded, small, cordate, orbicular or suborbicular leaves. It manifestly belongs in the same general group as the Philippine *Begonia nigritarum* Steud., although differing totally from that species in its vegetative characters.

THYMELAEACEÆ

Genus **PHALERIA** Jack

Phaleria perrottetiana (Decne.) F.-Vill.

Phaleria perrottetiana (Decne.) F.-VILL., Novis. App. Fl. Filip. (1880) 183; MERR., Enum. Philip. Fl. Pl. 3 (1923) 131.

No. 1382, in primary forests. Throughout the Philippines, although not otherwise known from outside the group. No representative of the genus is definitely recorded from Borneo proper.

LYTHRACEÆ

Genus **PEMPHIS** Forster

Pemphis acidula Forst.

Pemphis acidula Forst.; MERR., Enum. Born. Pl. (1921) 418; Enum. Philip. Fl. Pl. 3 (1923) 136.

No. 1436, along the seashore. A characteristic strand plant of the Old World Tropics, extending from East Africa to eastern Polynesia.

Genus **LAGERSTROEMIA** Linnæus

Lagerstroemia speciosa (Linn.) Pers.

Lagerstroemia speciosa (Linn.) Pers.; MERR., Enum. Born. Pl. (1921) 417; Enum. Philip. Fl. Pl. 3 (1923) 137.

Nos. 1105, 1712, in forests. India to southern China through Malaysia to tropical Australia.

Genus **LAWSONIA** Linnæus

Lawsonia inermis Linn.

Lawsonia inermis Linn.; MERR. Enum. Born. Pl. (1921) 418; Enum. Philip. Fl. Pl. 3 (1923) 138.

No. 1616, planted, as is generally the case in Malaysia. Pantropic in cultivation, native of eastern Africa or southwestern Asia.

SONNERATIACEÆ

Genus **SONNERATIA** Linnæus f.

Sonneratia caseolaris (Linn.) Engl.

Sonneratia caseolaris (Linn.) Engl.; MERR., Enum. Born. Pl. (1921) 418; Enum. Philip. Fl. Pl. 3 (1923) 139.

No. 1595, in mangrove swamps. A characteristic strand plant of the Indo-Malaysian region.

LECYTHIDACEÆ

Genus **BARRINGTONIA** Forster

Barringtonia asiatica (Linn.) Kurz.

Barringtonia asiatica (Linn.) Kurz; MERR., Enum. Born. Pl. (1921) 418; Enum. Philip. Fl. Pl. 3 (1923) 142.

No. 1437, along the seashore. A characteristic strand plant of the Indo-Malaysian and Polynesian regions, more generally known as *Barringtonia speciosa* Forst.

Barringtonia racemosa (Linn.) Blume.

Barringtonia racemosa (Linn.) Blume; MERR., Enum. Born. Pl. (1921) 419; Enum. Philip. Fl. Pl. 3 (1923) 142.

No. 1489, in open places. Widely distributed in the Indo-Malaysian and Polynesian regions.

RHIZOPHORACEÆ

Genus **CERIOPS** Arnott

Ceriops tagal (Perr.) C. B. Rob.

Ceriops tagal (Perr.) C. B. Rob.; MERR., Enum. Born. Pl. (1921) 420; Enum. Philip. Fl. Pl. 3 (1923) 144.

Nos. 1568, 1670, in mangrove swamps. Widely distributed in the Old World Tropics along tidal streams and marshy shores, more generally known as *Ceriops candolleana* Arn.

Genus **BRUGUIERA** Lamarck

Bruguiera parviflora (Roxb.) Wight & Arn.

Bruguiera parviflora (Roxb.) Wight & Arn.; MERR., Enum. Born. Pl. (1921) 421; Enum. Philip. Fl. Pl. 3 (1923) 147.

No. 1370, in mangrove swamps. Widely distributed in the Indo-Malaysian region.

Bruguiera sexangula (Lour.) Poir.

Bruguiera sexangula (Lour.) Poir.; MERR., Enum. Born. Pl. (1921) 422; Enum. Philip. Fl. Pl. 3 (1923) 147.

Nos. 1481, 1779, in mangrove swamps. Widely distributed in the Indo-Malaysian region, more generally known as *Bruguiera eriopetala* Wight & Arn.

COMBRETACEÆ

Genus **TERMINALIA** Linnæus

Terminalia catappa Linn.

Terminalia catappa Linn.; MERR., Enum. Born. Pl. (1921) 423; Enum. Philip. Fl. Pl. 3 (1923) 150.

No. 1642, along the seashore. Old World Tropics generally, near the sea; introduced into the American Tropics.

Genus **LUMNITZERA** Willdenow

Lumnitzera littorea (Jack) Voigt.

Lumnitzera littorea (Jack) Voigt; MERR., Enum. Born. Pl. (1921) 423; Enum. Philip. Fl. Pl. 3 (1923) 153.

No. 1429, in mangrove swamps. India to tropical Australia and Polynesia along the seashore.

MYRTACEÆ

Genus **RHODAMNIA** Jack

Rhodamnia cinerea Jack.

Rhodamnia cinerea Jack; MERR., Enum. Born. Pl. (1921) 423.

No. 1756, from Balambangan Island, in sandy soil. Burma through Malaysia to tropical Australia. No representative of the genus is known from the Philippines.

Genus **DECASPERMUM** Forster

Decaspermum fruticosum Forst.

Decaspermum fruticosum Forst.; MERR., Enum. Born. Pl. (1921) 424; Enum. Philip. Fl. Pl. 3 (1923) 155.

Nos. 1109, 1328, 1734, the last from Balambangan Island, on forested slopes. India through Malaysia to tropical Australia and Polynesia, this particular form more commonly known as *Decaspermum paniculatum* Kurz.

Genus **EUGENIA** Micheli

Eugenia alcinae Merr.

Eugenia alcinae Merr., Enum. Born. Pl. (1921) 425; Enum. Philip. Fl. Pl. 3 (1923) 157.

Nos. 1490, 1735, on slopes, both from Balambangan Island. Southern Luzon, Panay, Culion, Palawan, and British North Borneo.

Eugenia halophila Merr.?

Eugenia halophila Merr.?, Enum. Philip. Fl. Pl. 3 (1923) 167.

No. 1493, along the seashore. If not referable to the Philippine form, then closely allied to it. The inflorescences are terminal, not lateral.

Eugenia operculata Roxb.

Eugenia operculata Roxb.; Merr., Enum. Born. Pl. (1921) 431.

No. 1490, along the seashore. The specimen is in fruit and accordingly the correctness of the identification is not entirely certain. India to southern China and Java.

Eugenia mindorensis C. B. Rob.

Eugenia mindorensis C. B. Rob. in Philip. Journ. Sci. 4 (1909) Bot. 399; Merr., Enum. Philip. Fl. Pl. 3 (1923) 172.

No. 1532, from Balambangan Island, on slopes. Luzon, Mindoro, and Palawan. The inflorescences on the specimen cited above are longer than in the Philippine form.

Eugenia sp.

No. 1336, in open forests, a fruiting specimen matched by *D. D. Wood 1222* from Weston, British North Borneo. Apparently allied to the Palawan *Eugenia incarnata* Elm.

Genus **OSBORNIA** F. Mueller

Osbornia octodonta F. Muell.

Osbornia octodonta F. Muell.; Merr., Enum. Born. Pl. (1921) 435; Enum. Philip. Fl. Pl. 3 (1923) 182.

No. 1643, along the seashore. A monotypic genus, rather widely distributed in the Philippines along tidal streams, in British North Borneo, Celebes, and in northern Australia.

Genus **TRISTANIA** R. Brown

Tristania clementis Merr.

Tristania clementis MERR., Enum. Born. Pl. (1921) 435.

No. 1737, from Balambangan Island, near the seashore. An excellent match for the type, which was from Jessleton, British North Borneo.

Genus **RHODOMYRTUS** Reichenbach

Rhodomyrtus tomentosa (Ait.) Hassk.

Rhodomyrtus tomentosa (Ait.) Hassk.; MERR., Enum. Born. Pl. (1921) 425; Enum. Philip. Fl. Pl. 3 (1923) 156.

No. 1741, from Balambangan Island, in open sandy places. India to Japan and Malaysia.

MELASTOMATACEÆ

Genus **MELASTOMA** Burman

Melastoma polyanthum Blume.

Melastoma polyanthum Blume; MERR., Enum. Born. Pl. (1921) 437; Enum. Philip. Fl. Pl. 3 (1923) 188.

No. 1701, in open places. India to southern China through Malaysia to tropical Australia.

Genus **OCHTHOCHARIS** Blume

Ochthocharis javanica Blume.

Ochthocharis javanica Blume; MERR., Enum. Born. Pl. (1921) 439; Enum. Philip. Fl. Pl. 3 (1923) 189.

No. 1782, from Balambangan Island, in swamps. Burma to Java, Borneo, and Mindoro.

Genus **POGONANTHERA** Blume

Pogonanthera reflexa Blume.

Pogonanthera reflexa Blume; MERR., Enum. Born. Pl. (1921) 446; Enum. Philip. Fl. Pl. 3 (1923) 192.

No. 1682, epiphytic in forests. Malay Peninsula to Java, the Philippines and the Moluccas.

Genus **MEMECYLON** Linnæus

Memecylon paniculatum Jack.

Memecylon paniculatum Jack; MERR., Enum. Philip. Fl. Pl. 3 (1923) 216.

No. 1723, from Balambangan Island, in forests. Sumatra and Java to the Philippines; not recorded from Borneo proper.

ONAGRACEÆ

Genus **JUSSIAEA** Linnæus

Jussiaea erecta Linn.

Jussiaea erecta Linn.; MERR., Enum. Born. Pl. (1921) 455, as *J. suffruticosa* Linn.; Enum. Philip. Fl. Pl. 3 (1923) 219.

No. 1698, in cultivated land. A pantropic weed.

ARALIACEÆ

Genus **SCHEFFLERA** Forster

Schefflera insularum (Seem.) Harms.

Schefflera insularum (Seem.) Harms.; MERR., Enum. Philip. Fl. Pl. 3 (1923) 228.

No. 1112, in forests. Widely distributed in the Philippines, but hitherto not known from outside the Archipelago.

Schefflera odorata (Blanco) Merr. & Rolfe.

Schefflera odorata (Blanco) MERR. & ROLFE in Philip. Journ. Sci. 3 (1908) Bot. 117; MERR., Enum. Philip. Fl. Pl. 3 (1923) 230.

No. 1447, epiphytic in forests. Throughout the Philippines at low altitudes, but hitherto not known from outside the Archipelago.

ERICACEÆ

Genus **VACCINIUM** Linnæus

Vaccinium sp.

No. 1731, on slopes practically at sea level. The specimen lacks the corollas; it is entirely different from any of the Philippine species. Probably belongs in the group with *Vaccinium bancanum* Miq.

MYRSINACEÆ

Genus **AEGICERAS** Gaertner

Aegiceras corniculatum (Linn.) Blanco.

Aegiceras corniculatum (Linn.) Blanco; MERR., Enum. Born. Pl. (1921) 469; Enum. Philip. Fl. Pl. 3 (1923) 155.

Nos. 1556, 1718, in mangrove swamps and along the seashore. India to southern China through Malaysia to tropical Australia.

Aegiceras floridum Roem. & Schultes.

Aegiceras floridum Roem. & Schultes; MERR., Enum. Born. Pl. (1921) 469; Enum. Philip. Fl. Pl. 3 (1923) 256.

No. 1661, along the seashore. Borneo to the Philippines, Moluccas, and New Guinea.

Genus **ARDISIA** Swartz

Ardisia colorata Roxb.

Ardisia colorata Roxb.; MERR., Enum. Born. Pl. (1921) 470.

No. 1774, from Balambangan Island, in forests. India to Java and Borneo, but not known from the Philippines.

Ardisia serrata (Cav.) Pers.

Ardisia serrata (Cav.) Pers.; MERR., Enum. Born. Pl. (1921) 473; Enum. Philip. Fl. Pl. 3 (1923) 263.

No. 1452, on forested slopes. A form somewhat approaching *Ardisia pyramidalis* (Cav.) Pers. (*A. perrottetiana* A. DC.). Throughout the Philippines and in British North Borneo.

Ardisia squamulosa Presl.

Ardisia squamulosa Presl; MERR., Enum. Philip. Fl. Pl. 3 (1923) 263.

No. 1554, in open places. This form seems to be clearly the same as the Philippine *Ardisia boissieri* A. DC., which I have reduced to *A. squamulosa* Presl. It is not clearly distinct from *Ardisia humilis* Vahl, as interpreted by Mez. Throughout the Philippines, and probably in various parts of Malaysia.

Genus **DISCOCALYX** Mez

Discocalyx palawanensis Elm.

Discocalyx palawanensis ELM. ex Merr., Enum. Philip. Pl. 3 (1923) 269 (*Discocalyx merrillii* Elm. non Mez).

Nos. 1125, 1130, 1407, in forests. Mindoro, Palawan, and Bancalan in the Philippines, but not known from Borneo proper.

Genus **EMBELIA** Burman f.

Embelia philippinensis A. DC.

Embelia philippinensis A. DC.; MERR., Enum. Philip. Fl. Pl. 3 (1923) 272.

No. 1113, in thickets or forests. Throughout the Philippines, but known from outside the Archipelago only by this collection.

EBENACEÆ

Genus **MABA** Forster

Maba punctata Hiern.

Maba punctata Hiern; MERR., Enum. Born. Pl. (1921) 483.

Nos. 1342, 1534, in open forests. Widely distributed in Borneo, but not known elsewhere.

Genus **DIOSPYROS** Linnæus

Diospyros fasciculiflora Merr.

Diospyros fasciculiflora MERR. in Philip. Journ. Sci. 9 (1914) Bot. 334; Enum. Philip. Fl. Pl. 3 (1923) 292.

Nos. 1379, 1460, in primary forests. Throughout the Philippines, but not known elsewhere.

Diospyros maritima Blume.

Diospyros maritima Blume; MERR., Enum. Philip. Fl. Pl. 3 (1923) 292.

No. 1560, along the seashore. Near the sea, Java to the Philippines and New Guinea; not recorded from Borneo proper.

Diospyros spp.

Nos. 1409, 1666, 1706, representing three other species of this genus, all from forested slopes. The material is, however, scarcely sufficient to warrant an attempt to identify them further at this time.

SYMPLOCACEÆ

Genus **SYMPLOCOS** Jacquin

Symplocos nigricans Brand.

Symplocos nigricans Brand; MERR., Enum. Born. Pl. (1921) 487.

Nos. 1729, 1733, both from Balambangan Island, in forests. Previously known only from Borneo.

LOGANIACEÆ

Genus **FAGRAEA** Thunberg

Fagraea spicata Baker.

Fagraea spicata Baker; MERR., Enum. Born. Pl. (1921) 493.

No. 1768, in forests. Previously known only from British North Borneo proper.

APOCYNACEÆ

Genus **ALLAMANDA** Linnæus

Allamanda cathartica Linn.

Allamanda cathartica Linn.; MERR., Enum. Born. Pl. (1921) 495; Enum. Philip. Fl. Pl. 3 (1923) 320.

No. 1521, in open places. Pantropic in cultivation, a native of tropical America.

Genus ALSTONIA R. Brown

Alstonia macrophylla Wall.

Alstonia macrophylla Wall.; MERR., Enum. Born. Pl. (1921) 497; Enum. Philip. Fl. Pl. 3 (1923) 322.

No. 1492, near the seashore. Malay Peninsula to the Philippines and New Guinea.

Genus LOCHNERA Reichenbach

Lochnera rosea (Linn.) Reichb.

Lochnera rosea (Linn.) Reichb.; MERR., Enum. Born. Pl. (1921) 498; Enum. Philip. Fl. Pl. 3 (1923) 323.

Nos. 1391, 1589, in open places. Pantropic.

Genus KOPSIA Blume

Kopsia flavida Blume.

Kopsia flavida BLUME, Rumphia 4 (1848) 28; KOORD. & VAL., Bijdr. Boomsoort. Java 1 (1894) 96; Atlas Baumart. Java 4 (1916) *f. 633.*

No. 1626, along the seashore; the specimen agrees closely with the figure cited and with the descriptions. Previously known only from Java and New Guinea.

Kopsia parvifolia sp. nov.

Frutex vel arbor parva, glabra; ramis tenuibus, teretibus, in siccitate rubro-brunneis, ramulis compressis vel sulcatis, 1.5 mm diametro; foliis chartaceis vel submembranaceis, oblongis, in siccitate pallidis, nitidis, utrinque subaequaliter angustatis, basi acutis, plerumque leviter inaequilateralibus, apice breviter obtuseque acuminatis, 7 ad 10 cm longis, 3 ad 4.5 cm latis, glaberrimis, nervis primariis utrinque circiter 20, tenuibus; petiolo 2 ad 3 mm longo; inflorescentiis terminalibus, brevissimis, haud 1 cm longis, simplicibus vel furcatis, ramis bracteis multis triangulari-ovatis acutis vel acuminatis carinatis glabris 2 mm longis instructis; calycis lobis leviter pubescentibus; late ovatis ad orbiculari-ovatis, rotundatis, 2 ad 2.5 mm longis, extus sub apice glandulis solitariis instructis; corollae tubo tenue, apice leviter inflato, 3 ad 3.3 cm longo, lobis oblongis, obtusis, circiter 1.8 cm longis; fructibus junioribus ovoideis, rostratis, leviter pubescentibus, 1.3 cm longis.

BANGUEY ISLAND, *1456 P. Castro and F. Melegrito,* on forested slopes, September, 1923, flowers white.

A species characterized by its small leaves, which resemble those of some species of *Wikstroemia,* as well as by its short,

multibracteate inflorescences and obtuse calyx lobes. It is possibly as closely allied to *Kopsia ridleyana* King and Gamble of the Malay Peninsula as to any other described species.

Genus **PARSONSIA** R. Brown

Parsonsia cumingiana A. DC.

Parsonsia cumingiana A. DC.; MERR., Enum. Born. Pl. (1921) 502; Enum. Philip. Fl. Pl. 3 (1923) 338.

No. 1430, along the seashore. Widely distributed in the Philippines, otherwise known only from British North Borneo and Formosa.

ASCLEPIADACEÆ

Genus **ASCLEPIAS** Linnæus

Asclepias curassavica Linn.

Asclepias curassavica Linn.; MERR., Enum. Born. Pl. (1921) 503; Enum. Philip. Fl. Pl. 3 (1923) 341.

Nos. 1392, 1558, in open places. A pantropic weed of American origin.

Genus **TYLOPHORA** R. Brown

Tylophora tenuis Blume.

Tylophora tenuis Blume; MERR., Enum. Born. Pl. (1921) 504.

No. 1375, in forests. India to Burma, Borneo, and Java.

Genus **DISCHIDIA** R. Brown

Dischidia hirsuta (Blume) Decne.

Dischidia hirsuta (Blume) Decne.; MERR., Enum. Born. Pl. (1921) 505; Enum. Philip. Fl. Pl. 3 (1923) 348.

No. 1472, creeping over rocks along the seashore. Burma, to Java, Borneo, and the Philippines, usually near the sea.

CONVOLVULACEÆ

Genus **ERYCIBE** Roxburgh

Erycibe rheedii Blume.

Erycibe rheedii Blume; MERR., Enum. Philip. Fl. Pl. 3 (1923) 358.

No. 1608, in level forests. Sumatra, Java, and the Philippines. The specimen here cited is with fruits, so the identification cannot be considered as certain.

Genus **IPOMOEA** Linnæus

Ipomoea gracilis R. Br.

Ipomoea gracilis R. Br.; MERR., Enum. Born. Pl. (1921) 509; Enum. Philip. Fl. Pl. 3 (1923) 365.

No. 1475, along the seashore. Widely distributed in the Old World Tropics near the sea.

Ipomoea digitata Linn.

Ipomoea digitata Linn.; MERR., Enum. Philip. Fl. Pl. 3 (1923) 364; Enum. Born. Pl. (1921) 510, as *I. paniculata* R. Br., a synonym.

No. 1631, near the seashore. All tropical countries.

Genus **QUAMOCLIT** Moench

Quamoclit pennata (Desr.) Bojer.

Quamoclit pennata (Desr.) Bojer; MERR., Enum. Born. Pl. (1921) 510; Enum. Philip. Fl. Pl. 3 (1923) 370.

No. 1423, in cultivated lands. Pantropic; of American origin.

BORAGINACEÆ

Genus **CORDIA** Linnæus

Cordia dichotoma Forst. f.

Cordia dichotoma Forst. f.; MERR., Enum. Philip. Fl. Pl. 3 (1923) 373.

No. 1540, in open places. India to southern China, through Malaysia to tropical Australia and Polynesia; more commonly known as *C. myxa* (non Linn.). Not recorded from Borneo proper.

Cordia subcordata Lam.

Cordia subcordata Lam.; MERR., Enum. Philip. Fl. Pl. 3 (1923) 374.

No. 1708, along the seashore. A characteristic strand plant of the Old World Tropics. No representative of the genus has hitherto been recorded from Borneo.

VERBENACEÆ

Genus **LANTANA** Linnæus

Lantana camara Linn.

Lantana camara Linn.; MERR., Enum. Born. Pl. (1921) 511; Enum. Philip. Fl. Pl. 3 (1923) 380.

No. 1544, in open places. Pantropic; of American origin.

Genus **CALLICARPA** Linnæus

Callicarpa erioclona Schauer.

Callicarpa erioclona Schauer; MERR., Enum. Philip. Fl. Pl. 3 (1923) 384.

Nos. 1573, 1714, in open forests. Throughout the Philippines, extending to Borneo, Celebes, New Guinea, New Britain, and New Ireland.

Genus **PREMNA** Linnæus

Premna obtusifolia R. Br.

Premna obtusifolia R. Br., MERR., Enum. Philip. Fl. Pl. 3 (1923) 392; Enum. Born. Pl. (1921) 513, as *Premna cyclophylla* Miq., a synonym.

No. 1648, along the seashore. Near the sea, Philippines and Malaysia to tropical Australia.

Genus **VITEX** Linnæus

Vitex negundo Linn.

Vitex negundo Linn.; MERR., Enum. Born. Pl. (1921) 514; Enum. Philip. Fl. Pl. 3 (1923) 394.

No. 1636, along the seashore, representing the variety *bicolor* (Willd.) Lam. Widely distributed in the Old World Tropics, extending from eastern Africa to Polynesia.

Vitex quinata (Lour.) F. N. Will.

Vitex quinata (Lour.) F. N. Will.; MERR., Enum. Philip. Fl. Pl. 3 (1923) 396.

No. 1592, in open forests; a form with trifoliolate leaves. India to Formosa through Malaysia to Celebes; not recorded from Borneo proper.

Vitex pubescens Vahl.

Vitex pubescens Vahl; MERR., Enum. Born. Pl. (1921) 514; Enum. Philip. Fl. Pl. 3 (1923) 396.

No. 1511, in open forests. India to Java, Timor, and Celebes, extending through Palawan into Mindoro, also in Guimaras and in the Sulu Archipelago in the Philippines.

Genus **GMELINA** Linnæus

Gmelina elliptica Sm.

Gmelina elliptica Sm.; MERR., Enum. Born. Pl. (1921) 515, as *G. villosa* Roxb., a synonym; Enum. Philip. Fl. Pl. 3 (1923) 399.

No. 1334, in open forests. Burma through Malaysia to the Moluccas and the Palau Islands.

Genus **AVICENNIA** Linnæus

Avicennia marina (Forsk.) Vierh.

Avicennia marina (Forsk.) Vierh.; MERR., Enum. Born. Pl. (1921) 518, as *A. officinalis* (non Linn.); Enum. Philip. Fl. Pl. 3 (1923) 407.

Nos. 1579, 1703, in mangrove swamps and along the seashore. India to Malaysia, tropical Australia, and Polynesia.

LABIATÆ

Genus **DYSOPHYLLA** Blume

Dysophylla auricularia (Linn.) Blume.

Dysophylla auricularia (Linn.) Blume; MERR., Enum. Born. Pl. (1921) 530; Enum. Philip. Fl. Pl. 3 (1923) 415.

No. 1630, near the seashore. India to southern China and the Malay Achipelago generally.

Genus **HYPTIS** Jacquin

Hyptis brevipes Poir.

Hyptis brevipes Poir.; MERR., Enum. Born. Pl. (1921) 520; Enum. Philip. Fl. Pl. 3 (1923) 416.

No. 1372, in open places. A pantropic weed of American origin.

Genus **OCIMUM** Linnæus

Ocimum basilicum Linn.

Ocimum basilicum Linn.; MERR., Enum. Born. Pl. (1921) 520; Enum. Philip. Fl. Pl. 3 (1923) 421.

Nos. 1359, 1432, 1742, the last from Balambangan Island, in open places, locally known as *kamangi.* Pantropic, cultivated and spontaneous.

Ocimum sanctum Linn.

Ocimum sanctum Linn.; MERR., Enum. Born. Pl. (1921) 521; Enum. Philip. Fl. Pl. 3 (1923) 422.

Nos. 1467, 1522, in open places. Range of the preceding species.

SOLANACEÆ

Genus **PHYSALIS** Linnæus

Physalis minima Linn.

Physalis minima Linn.; MERR., Enum. Born. Pl. (1921) 521; Enum. Philip. Fl. Pl. 3 (1923) 423.

No. 1628, near the seashore. A pantropic weed.

Genus **CAPSICUM** Tournefort

Capsicum annuum Linn., var.

Capsicum annuum Linn., var.; MERR. Enum. Philip. Fl. Pl. 3 (1923) 423.

Nos. 1344, 1542, in open places, one form with narrow elongated fruits about 4 cm long, the other with globose or ovoid fruits about 1 cm long. Pantropic, usually in cultivation.

Genus **SOLANUM** Tournefort

Solanum cyanocarphium Blume.

Solanum cyanocarphium BLUME, Bijdr. (1825) 700.
Solanum sarmentosum NEES in Trans. Linn. Soc. 17 (1837) 58; RIDL., Fl. Mal. Penin. 2 (1923) 469.
Solanum sparsiflorum ELM., Leafl. Philip. Bot. 5 (1913) 1838; MERR., Enum. Philip. Fl. Pl. 3 (1923) 428.

No. 1504, in open places near the sea. Malay Peninsula to Java, Palawan, Bohol, and Mindanao.

Solanum torvum Sw.

Solanum torvum Sw.; MERR., Enum. Born. Pl. (1921) 522; Enum. Philip. Fl. Pl. 3 (1923) 428.

No. 1360, in open places. Pantropic.

Solanum verbascifolium Linn.

Solanum verbascifolium Linn.; MERR., Enum. Born. Pl. (1921) 522; Enum. Philip. Fl. Pl. 3 (1923) 429.

No. 1543, in open places. Pantropic.

Genus **NICOTIANA** Linnæus

Nicotiana tabacum Linn.

Nicotiana tabacum Linn.; MERR., Enum. Born. Pl. (1921) 522; Enum. Philip. Fl. Pl. 3 (1923) 430.

No. 1479, planted. All warm countries in cultivation. Tobacco.

SCROPHULARIACEÆ

Genus **SCOPARIA** Linnæus

Scoparia dulcis Linn.

Scoparia dulcis Linn.; MERR., Enum. Born. Pl. (1921) 525; Enum. Philip. Fl. Pl. 3 (1923) 441.

No. 1551, in open places. A pantropic weed of American origin.

Genus **LINDERNIA** Allioni

Lindernia crustacea (Linn.) F. Muell.

Lindernia crustacea (Linn.) F. Muell.; MERR., Enum. Born. Pl. (1921) 524; Enum. Philip. Fl. Pl. 3 (1923) 437.

No. 1358, in open places. Widely distributed in the Old World Tropics, introduced in tropical America; more commonly known as *Vandellia crustacea* Benth.

Genus **CURANGA** Jussieu

Curanga fel-terrae (Lour.) Merr.

Curanga fel-terrae (Lour.) MERR., Enum. Born. Pl. (1921) 524; Enum. Philip. Fl. Pl. 3 (1923) 439.

No. 1527, in forests. India to Indo-China through Malaysia to the Moluccas; more generally known as *Curanga amara* Juss.

BIGNONIACEÆ

Genus **DOLICHANDRONE** Fenzl

Dolichandrone spathacea (Linn. f.) K. Schum.

Dolichandrone spathacea (Linn. f.) K. Schum.; MERR., Enum. Born. Pl. (1921) 525; Enum. Philip. Fl. Pl. 3 (1923) 444.

No. 1369, along tidal streams. India through Malaysia to New Guinea.

PEDALIACEÆ

Genus **SESAMUM** Linnæus

Sesamum indicum Linn.

Sesamum indicum Linn.; MERR., Enum. Born. Pl. (1921) 526; Enum. Philip. Fl. Pl. 3 (1923) 448.

No. 1442, in open places. Throughout the Old World Tropics, frequently cultivated. Sesame.

ACANTHACEÆ

Genus **THUNBERGIA** Linnæus

Thunbergia fragrans Roxb.

Thunbergia fragrans Roxb.; MERR., Enum. Born. Pl. (1921) 538; Enum. Philip. Fl. Pl. 3 (1923) 468.

No. 1113, in thickets. India through Malaysia to tropical Australia.

Genus **HEMIGRAPHIS** Nees

Hemigraphis cumingiana (Nees) F.-Vill.

Hemigraphis cumingiana (Nees) F.-Vill.; MERR., Enum. Philip. Fl. Pl. 3 (1923) 471.

No. 1338, in open forests. Luzon, Panay, Celebes. The specimen here referred to the Philippine species closely resembles some forms of *Hemigraphis alternata* T. Anders., of the Malay Peninsula, Sumatra, Java, and Borneo.

Genus **ACANTHUS** Tournefort

Acanthus ebracteatus Vahl.

Acanthus ebracteatus Vahl; MERR., Enum. Born. Pl. (1921) 540; Enum. Philip. Fl. Pl. 3 (1923) 479.

No. 1364, along tidal streams. Andaman Islands to Indo-China, through Malaysia to new Guinea and the Palau Islands.

Genus **JUSTICIA** Linnæus

Justicia gendarussa Burm. f.

Justicia gendarussa Burm. f.; MERR., Enum. Born. Pl. (1921) 543; Enum. Philip. Fl. Pl. 3 (1923) 489.

Nos. 1674, 1526, in open forests along streams. Widely distributed in the Indo-Malaysian region.

Genus **PSEUDERANTHEMUM** Radlkofer

Pseuderanthemum sp.

No. 1611, in open places. The specimen is without flowers and matches material recently collected in the Sulu Archipelago. Apparently an undescribed form.

RUBIACEÆ

Genus **HEDYOTIS** Linnæus

Hedyotis radicans (DC.) Miq.

Hedyotis radicans (DC.) Miq.; MERR., Enum. Philip. Fl. Pl. 3 (1923) 499.

No. 1677, in open places. Widely distributed in the Philippines, but not reported elsewhere.

Genus **UNCARIA** Schreber

Uncaria ferrea (Blume) DC.

Uncaria ferrea (Blume) DC.; MERR., Enum. Born. Pl. (1921) 552.

No. 1532, in forests. Burma to Sumatra, Java, and Borneo.

Genus **NEONAUCLEA** Merrill

Neonauclea formicaria (Elm.) Merr.

Neonauclea formicaria (Elm.) MERR., Enum. Philip. Fl. Pl. 3 (1923) 512.

No. 1411, in forests. Widely distributed in the Philippines; closely allied to *N. reticulata* Merr., and apparently also to *N. gigantea* Merr. Also in British North Borneo.

Genus **MYRMECONAUCLEA** Merrill

Myrmeconauclea strigosa (Korth.) Merr.

Myrmeconauclea strigosa (Korth.) MERR., Enum. Born. Pl. (1921) 554; Enum. Philip. Fl. Pl. 3 (1923) 517.

No. 1716, along streams in forests. Palawan and Busuanga in the Philippines, and in Borneo, a monotypic genus.

Genus **MUSSAENDA** Linnæus

Mussaenda acuminata Blume.

Mussaenda acuminata Blume; MERR., Enum. Born. Pl. (1921) 555.

No. 1651, an erect shrub in forests. Java and Borneo.

The identification of this specimen with Blume's species is not certainly correct as the plant is with fruits. It conforms closely with Miquel's amplified description of Blume's species, which perhaps has been confused with *Mussaenda glabra* Vahl and *M. frondosa* Linn. I doubt if typical *Mussaenda frondosa* Linn. occurs in the Malay Archipelago. The Malaysian representatives of this genus are very badly in need of critical revision.

Mussaenda villosa Wall.

Mussaenda villosa Wall.; RIDLEY, Fl. Mal. Penin. 2 (1923) 60.

Nos. 1114, 1512, 1755, the last from Balambangan Island, an erect shrub in forests. Siam to the Malay Peninsula, Sumatra, and Borneo.

Mussaenda sp.

No. 1402, a woody vine in primary forests; a fruiting specimen, calyx lobes deciduous.

Genus **TARENNA** Gaertner

Tarenna cumingiana (Vid.) Elm.

Tarenna cumingiana (Vid.) ELM., Leafl. Philip. Bot. 5 (1913) 1898; MERR., Enum. Philip. Fl. Pl. 3 (1923) 525.

Nos. 1107, 1601, in level forests. Luzon to Mindoro and Mindanao in the Philippines, and in British North Borneo.

Genus **RANDIA** Houstoun

Randia patula Miq.

Randia patula Miq.; MERR., Enum. Born. Pl. (1921) 563.

No. 1763, from Balambangan Island, in forests. Borneo and Java.

Randia racemosa (Cav.) F.-Vill.

Randia racemosa (Cav.) F.-Vill.; MERR., Enum. Born. Pl. (1921) 563; Enum. Philip. Fl. Pl. 3 (1923) 528.

No. 1438, in forests near the seashore. Malay Peninsula and Archipelago to the Riu Kiu Islands, tropical Australia, and the Marianne Islands.

Genus **GARDENIA** Ellis

Gardenia merrillii Elm.

Gardenia merrillii Elm.; MERR., Enum. Born. Pl. (1921) 564; Enum. Philip. Fl. Pl. 3 (1923) 530.

No. 1781, from Balambangan Island, in forests. Luzon to Palawan and British North Borneo, and apparently also in Celebes.

Genus **PETUNGA** de Candolle

Petunga racemosa (Roxb.) K. Schum.

Petunga racemosa (Roxb.) K. Schum.; MERR., Enum. Born. Pl. (1921) 565; Enum. Philip. Fl. Pl. 3 (1923) 533.

Nos. 1115, 1445, in forests. Malay Peninsula to Sumatra, Java, Borneo, and Balabac and Palawan in the Philippines.

Genus **SCYPHIPHORA** Gaertner f.

Scyphiphora hydrophyllacea Gaertn. f.

Scyphiphora hydrophyllacea Gaertn. f.; MERR., Enum. Born. Pl. (1921) 566; Enum. Philip. Fl. Pl. 3 (1923) 533.

No. 1680, in mangrove swamps. Within the influence of salt or brackish water, India through Malaysia to New Caledonia.

Genus **PLECTRONIA** Linnæus

Plectronia conferta (Korth.) Merr.

Plectronia conferta (Korth.) MERR., Enum. Born. Pl. (1921) 567.

No. 1728, from Balambangan Island, on slopes. Malay Peninsula, Penang, Bangka, and Borneo.

Genus **GUETTARDA** Linnæus

Guettarda speciosa Linn.

Guettarda speciosa Linn.; MERR., Enum. Born. Pl. (1921) 568; Enum. Philip. Fl. Pl. 3 (1923) 539.

No. 1416, along the seashore. A pantropic strand plant.

Genus **TIMONIUS** de Candolle

Timonius flavescens (Jack) Baker.

Timonius flavescens (Jack) Baker; MERR., Enum. Born. Pl. (1921) 568.

Nos. 1766, 1783, in forests. Malay Peninsula, Sumatra, and Borneo; the Mauritius form referred here is probably distinct.

Genus **PAVETTA** Linnæus

Pavetta indica Linn.

Pavetta indica Linn.; MERR., Enum. Born. Pl. (1921) 570; Enum. Philip. Fl. Pl. 3 (1923) 544.

No. 1600, in level forests. India to southern China through Malaysia to tropical Australia.

Genus **IXORA** Linnæus

Ixora grandifolia Zoll. & Mor.

Ixora grandifolia Zoll. & Mor.; MERR., Enum. Born. Pl. (1921) 571.

No. 1106, in forests. Malay Peninsula, Sumatra, Java, and Borneo.

Ixora javanica (Blume) DC.

Ixora javanica (Blume) DC.; MERR., Enum. Born. Pl. (1921) 572.

No. 1598, with doubt. The specimen is in fruit, so that the accuracy of the identification is doubtful. Java, Sumatra, and Borneo.

Ixora palawanensis Merr.

Ixora palawanensis MERR. in Philip. Journ. Sci. 5 (1910) Bot. 550.

Nos. 1340, 1717, 1773, the last from Balambangan Island. In open forests. Culion and Palawan in the Philippine group.

Ixora paludosa (Blume) Boerl.

Ixora paludosa (Blume) Boerl; MERR., Enum. Born. Pl. (1921) 572.

No. 1435, near the seashore. Sumatra, Java, and Borneo.

Ixora philippinensis Merr.

Ixora philippinensis MERR., Enum. Born. Pl. (1921) 572; Enum. Philip. Fl. Pl. 3 (1923) 550.

No. 1419, near the seashore. Throughout the Philippines, also in Celebes and in British North Borneo.

Ixora tenelliflora sp. nov.

Frutex circiter 2.5 m altus, inflorescentiis tenuiter longissime pedunculatis minute puberulis exceptis glaber; ramulis tenuibus, subteretibus, circiter 1.5 mm diametro; foliis membranaceis, in siccitate viridi-olivaceis, subtus pallidioribus, subnitidis, oblongo-oblanceolatis ad anguste oblongo-obovatis, breviter petiolatis, 15 ad 23 cm longis, 6 ad 8.5 cm latis, apice abrupte et brevissime triangulari-acuminatis, deorsum angustatis, basi obtusis ad acutis; nervis lateralibus utrinque 10 ad 13, subtus perspicuis, laxe arcuato-anastomosantibus; stipulis 4 ad 5 mm longis, abrupte acuminatis; petiolo circiter 4 mm longo; inflorescentiis terminalibus lateralibusque, ut videtur pendulis, longissime tenuiterque pedunculatis, 18 ad 24 cm longis, multifloris, pedunculo 12 ad 15 cm longo, puberulo, bracteis ovatis, acutis vel acuminatis, circiter 3 mm longis; cymis 8 ad 10 cm longis, ramis paucis, multifloris, usque ad 3 cm longis; floribus albidis, tenuiter (2 ad 5 mm) pedicellatis, bracteolis minutis, calyce minute puberulo, 1 ad 1.5 mm longo, brevissime undulato-crenato vel undulato-dentato; corollae tubo tenue, vix 0.5 mm diametro, circiter 3.5 cm longo, lobis oblongis, patulis vel reflexis, 8 ad 10 mm longis.

BANGUEY ISLAND, *1384 P. Castro and F. Melegrito,* August 1, 1923, in primary forests at low altitudes.

A species strongly characterized by its membranaceous leaves and especially by its long and slenderly peduncled, many-flowered inflorescences, which are both terminal and lateral and apparently pendulous, as well as by its long, very slender, white flowers. In some specimens the axillary peduncles spring from the old wood of stems or branches 1 cm in diameter. Its alliance is probably with *Ixora rivalis* Valeton.

Ixora sp.

No. 1123, a fruiting specimen, probably belonging in the group with the Philippine *Ixora bartlingii* Elm.

Genus **PSYCHOTRIA** Linnæus

Psychotria bangueyensis sp. nov.

Frutex erectus, 3 ad 6 m altus, plus minusve ferrugineo-pubescente, ramis glabris, ramulis 1.5 ad 2 mm diametro, teretibus, junioribus perspicue ferrugineo-hirsutis; foliis chartaceis,

oblongo-lanceolatis ad oblongo-oblanceolatis, utrinque angustatis, apice acutis vel leviter acuminatis, basi cuneatis, 9 ad 12 cm longis, 2.5 ad 4.5 cm latis, supra glaberrimis vel junioribus ad basin leviter ferrugineo-ciliatis, in siccitate pallide olivaceis vel brunneis, nitidis, subtus pallidioribus, praesertim ad costa nervisque plus minusve ferrugineo-villosis, nervis lateralibus utrinque circiter 11, subtus perspicuis, ad margine curvato-anastomosantibus, reticulis laxis, obscuris; petiolo 5 ad 10 mm longo, ferrugineo-pubescenti; stipulis caducis; inflorescentiis terminalibus, sessilibus, ferrugineo-pubescentibus, paucifloris, circiter 1.5 cm longis; floribus 5-meris, sessilibus, calyce leviter pubescenti, tubo circiter 0.8 mm longo, brevissime 5-dentato, dentibus triangulari-acutis, quam tubo multo brevioribus; corollae tubo 3 mm longo, extus leviter pubescenti, lobis oblongis, quam tubo paullo brevioribus; infructescentiis circiter 4 cm longis, fructibus obovoideis, laevis, glabris, haud sulcatis, in siccitate castaneis, 6 mm longis, pyrenis plano-convexis, haud sulcatis vel carinatis, albumine aequabile.

BANGUEY ISLAND, *1678 P. Castro and F. Melegrito*, August, 1923 (type); also *No. 1738* from Balambangan Island, May, 1923. In forests at low altitudes.

In superficial characters resembling *Psychotria rhinocerotis* Blume, but not closely allied to that species, differing among other characters in its very much smaller leaves, very short calyx segments, and noncostate fruits and seeds.

Psychotria malayana Jack.

Psychotria malayana Jack; MERR., Enum. Born. Pl. (1921) 574; Enum. Philip. Fl. Pl. 3 (1923) 558.

No. 1746, from Balambangan Island, in old clearings. Malay Peninsula, Sumatra, Java, Borneo, and parts of the Philippines.

Psychotria membranifolia Bartl.

Psychotria membranifolia Bartl.; MERR., Enum. Philip. Fl. Pl. 3 (1923) 559.

Nos. 1446, 1705, in forests. Luzon to Mindanao in the Philippines, but hitherto not recorded from outside the group. *No. 1597* may represent an allied species.

Psychotria sarmentosa Blume.

Psychotria sarmentosa Blume; MERR., Enum. Born. Pl. (1921) 575.

No. 1453, on slopes, altitude about 200 meters. Sumatra, Java, and Borneo.

Genus **HYDNOPHYTUM** Jack

Hydnophytum formicarium Jack.

Hydnophytum formicarium Jack; MERR., Enum. Born. Pl. (1921) 579; Enum. Philip. Fl. Pl. 3 (1923) 568.

No. 1465, epiphytic, near the seashore. Siam and Indo-China through Malaysia to the Philippines and Celebes.

Genus **GAERTNERA** Lamarck

Gaertnera vaginans (DC.) Merr.

Gaertnera vaginans (DC.) MERR., Enum. Born. Pl. (1921) 580.

No. 1765, from Balambangan Island, on slopes. Ceylon, Malay Peninsula. It is not certain that the Bornean form is really the same as *Psychotria vaginans* DC. No representative of the genus has been found in the Philippines.

Genus **PAEDERIA** Linnæus

Paederia verticillata Blume.

Paederia verticillata Blume; MERR., Enum. Born. Pl. (1921) 580; Enum. Philip. Fl. Pl. 3 (1923) 570.

No. 1675, in forests. Malay Peninsula to Java and the Philippines.

Genus **MORINDA** Linnæus

Morinda citrifolia Linn.

Morinda citrifolia Linn.; MERR., Enum. Born. Pl. (1921) 581; Enum. Philip. Fl. Pl. 3 (1923) 573.

No. 1584, along the seashore, local name *bangkuru.* India to Polynesia.

Morinda philippinensis Elm.

Morinda philippinensis ELM., Leafl. Philip. Bot. 3 (1911) 1044; MERR., Enum. Philip. Fl. Pl. 3 (1923) 573.

No. 1676, in open places. Sibuyan, Mindoro, and Palawan in the Philippines. The globose fruits are about 2 cm in diameter, considerably smaller than those of the Palawan form, the fruits of which are described by Mr. Elmer as being nearly 2 inches in diameter.

CUCURBITACEÆ

Genus **MELOTHRIA** Linnæus

Melothria affinis King.

Melothria affinis King; COGN. in Engl. Pflanzenreich 69 (1916) 94.

No. 1652, in cultivated lands. Malay Peninsula and Dutch Borneo.

GOODENIACEÆ

Genus **SCAEVOLA** Linnæus

Scaevola frutescens (Mill.) Krause.

Scaevola frutescens (Mill.) Krause; MERR., Enum. Born. Pl. (1921) 586; Enum. Philip. Fl. Pl. 3 (1923) 590.

No. 1367, along the seashore. A characteristic strand plant of the Old World Tropics.

COMPOSITÆ

Genus **VERNONIA** Schreber

Vernonia arborea Ham.

Vernonia arborea Ham.; MERR., Enum. Born. Pl. (1921) 586; Enum. Philip. Fl. Pl. 3 (1923) 592.

Nos. 1487, 1508, in open places. This is Hamilton's species, sensu latiore, and is widely distributed in the Indo-Malaysian region. Ridley [9] states that true *Vernonia arborea* Ham. is an Indian species, and he adopts the name *Vernonia javanica* DC. for the Malaysian form.

Vernonia pyrrhopappa Schulz-Bip.

Vernonia pyrrhopappa Schulz-Bip.; MERR., Enum. Philip. Fl. Pl. 3 (1923) 595.

Nos. 1356, 1545, in open forests. Central and southern Philippines and the Palawan group. The specimens represent the Palawan form described by Mr. Elmer as *Vernonia villarii;* a critical revision of this group of scandent species may show that the latter, which I have reduced to *V. pyrrhopappa,* is distinct.

Genus **ADENOSTEMMA** Forster

Adenostemma lavenia (Linn.) O. Kuntze.

Adenostemma lavenia (Linn.) O. Kuntze; MERR., Enum. Born. Pl. (1921) 587; Enum. Philip. Fl. Pl. 3 (1923) 596.

No. 1699, in cultivated lands. A pantropic weed.

Genus **ERIGERON** Linnæus

Erigeron sumatrensis Retz.

Erigeron sumatrensis Retz.; MERR., Enum. Born. Pl. (1921) 587, as *E. linifolius* Willd.; Enum. Philip. Fl. Pl. 3 (1923) 600.

No. 1524, in open places. All warm countries.

[9] Fl. Mal. Penin. 2 (1923) 187.

Genus **BLUMEA** de Candolle

Blumea balsamifera (Linn.) DC.

Blumea balsamifera (Linn.) DC.; MERR., Enum. Born. Pl. (1921) 587; Enum. Philip. Fl. Pl. 3 (1923) 601.

No. 1528, in open places. India to southern China through Malaysia to the Moluccas.

Genus **WEDELIA** Jacquin

Wedelia biflora (Linn.) DC.

Wedelia biflora (Linn.) DC.; MERR., Enum. Born. Pl. (1921) 588; Enum. Philip. Fl. Pl. 3 (1923) 611.

No. 1550, along the seashore. India to tropical Australia and Polynesia, chiefly near the sea.

Genus **BIDENS** Tournefort

Bidens pilosa Linn.

Bidens pilosa Linn.; MERR., Enum. Born. Pl. (1921) 589; Enum. Philip. Fl. Pl. 3 (1923) 614.

Nos. 1557, 1689, in open places. A pantropic weed.

Genus **ARTEMISIA** Linnæus

Artemisia vulgaris Linn.

Artemisia vulgaris Linn.; MERR., Enum. Philip. Fl. Pl. 3 (1923) 616.

Nos. 1354, 1633, in open places. All warm countries, introduced here as it is in other parts of Malaysia. Not reported from Borneo proper, but certainly occurring there.

Genus **EMILIA** Cassini

Emilia sonchifolia (Linn.) DC.

Emilia sonchifolia (Linn.) DC.; MERR. Enum. Born. Pl. (1921) 590; Enum. Philip. Fl. Pl. 3 (1923) 620.

No. 1653, in open places. A pantropic weed of Old World origin.

ILLUSTRATION

TEXT FIGURE

BEITRAG ZUR KENNTNIS DER HOMOPTEREN-FAUNA DER PHILIPPINEN

Von H. Haupt

Halle a. d. S., Germany

EINE TAFEL

Die hier beschriebenen Homoptera wurden mir von der Firma Dr. V. Staudinger und A. Bang-Haas in Dresden-Blasewitz zur Bestimmung zugesandt. Sie entstammen der Ausbeute die Herr Böttcher, den Herr Hauptmann Moser 1913 nach den Philippinen gesandt hatte, im Jahre 1919 zurückbrachte. Die *Huechys*-Arten, die darunter waren, erscheinen in meiner Bearbeitung dieser Gattung.[1] Die schon bekannten Homoptera, die sich unter der Ausbeute befanden, habe ich mit aufgezählt, auch deren Fundorte genannt, um späteren tiergeographischen Bearbeitungen der ostasiatischen Inselwelt Grundlagen zu geben. Die Derbidæ habe ich ausgelassen und behalte mir deren Bearbeitung und Aufzählung für später vor.

Die Typen befinden sich in meiner Sammlung.

FULGORIDÆ

Subfamilia CIXIINÆ

Tribus DICTYOPHARINI Stål

Dictyomorpha hectica sp. nov.

Der *D. elongata* Mel. sehr ähnlich. Der wesentlichste Unterschied von dieser Art besteht darin, dass der sehr lange Kopffortsatz sich dicht vor dem Ende etwas erweitert und dann kurz zuspitzt, und zwar rechtwinklig.

Der ganze Körper einschliesslich der Flügel und Beine grün; auch die Dornen der Beine sind völlig grün; braun sind nur die Augen und die Krallen. Der Mittelkiel des Scheitels nur zwischen den Augen und ein wenig darüber hinaus deutlich, nachher nur noch kaum wahrnehmbar; alle übrigen Kiele an Kopf, Pronotum und Scutum wie bei *D. elongata;* völlige Uebereinstimmung auch beim Flügelgeäder.

[1] Deutsch. Ent. Zeitsch. Berlin, Heft 3 (1924).

Gesamtlänge bei angelegten Flügeln, 18 Millimeter; Kopf, 5.5 Millimeter; Pronotum + Scutum, 3 Millimeter; Vorderflügel, 11 Millimeter.

LUZON, Laguna, Mount Banahao.

Mir lagen zwei Stücke vor.

Von weiteren Dictyopharini lagen mir vor *Dictyophara javana* Leth., 1 Stück von Mindanao, Lanao, Momungan, und zahlreiche Stücke des Zuckerrohr-Schädlings, *D. pallida* Don.

Die Gattung *Dictyophara* muss *Fulgora* heissen, da Latreille 1810 *Fulgora europaea* L. als Genotype festlegte.

Tribus CIXIINI Stål

Dystheatias punctata Melichar.

Mir lagen 5 Stücke vor: 4 zitronengelbe mit gleichfarbigen Punkten auf den Vorderflügeln, von Luzon, Kalinga, Balbalasang: Ifugao, Mount Polis, und ein brauner mit dunkleren Punkten auf den Adern, von Mindanao, Surigao, Surigao. Da skulpturelle Unterschiede nicht nachweisbar sind, halte ich beide Tiere für Vertreter obiger Art und stelle *D. fuscovenosa* Mel. als Synonym dazu.

Melichar schreibt:[2] "Ocellen klein, die 3. Ocelle nicht vorhanden." Dazu möchte ich bemerken, dass die Ocellen relativ durchaus nicht klein sind, und dass die dritte Ocelle vorhanden ist, nur ist sie im Verhältnis zu den beiden andern Ocellen sehr klein und ferner schwer sichtbar, weil sie hinter der Umbiegung des Stirnkieles zum Clypeus liegt und darum nach unten gerichtet ist.

Subfamilia TROPIDUCHINÆ Stål

Tribus TROPIDUCHINI

Daradax nebulosus sp. nov.

Kopf etwas kürzer als Pronotum und Scutum zusammen, und deshalb in die Nähe von *D. nasutus* Mel. gehörig. Scheitel an den Seiten geradlinig, nach vorn um die Hälfte verengt, an der Spitze abgerundet. Seitenränder der Stirn in der unteren Hälfte kaum merklich konkav. Grün; gelblich-braun sind die Kiele des Kopfes und des Scutums, die Costa, die Spitze der Vorderflügel auf der Innenseite bis zur Subapicallinie und der Schlussrand des Clavus; dunkelbraun sind je ein Punkt in der Clavusspitze und im Ende der zweiten Discoidalzelle (von aussen!), ferner zahlreiche kleine zusammenhängende Pünktchen

[2] Philip. Journ. Sci. § D 9 (1914) 174.

in der gebräunten Flügelspitze. Zwischen den Adern der Vorderflügel befinden sich verwaschene, mattbraune, ausgezackte Flecken, die so weit auseinander stehen, als ihr Durchmesser beträgt. Hinterflügel milchweiss, mit grünen Adern. Grösse, 12 bis 13 Millimeter.

Fünf Stücke von Mindanao, Zamboanga, Port Banga.

Ferner lagen mir vor 6 Stücke von *Neocatara philippinensis* Dist. von Mindanao, Surigao.

Tribus TAMBINIINI

Taxilana ornata sp. nov.

Diese und die folgende Art haben auf dem Scheitel nur einen Mittelkiel wie *T. fuscocoriata* Muir, *laratica* Muir, *cruenta* Mel., und *apicalis* Mel.; sie bilden aber eine Gruppe für sich, da sie grüne Vorderflügel besitzen, denen jede Spur von Körnung fehlt. Die Angabe bei Melichar,[3] "Die Zellen des Coriums mit feinen Körnchen besetzt," hat demnach als Charakteristicum der Gattung auszuscheiden.

Körper und Flügel grün; Kiel und Ränder des Scheitels und Mittelkiel des Pronotums rötlich angehaucht; gelb sind die Seiten des Scutums ausserhalb der Kiele und die obere Hälfte des Clavus vom Schlussrand bis zur Ader; blutrot sind der Mittelteil des Scutums zwischen den Kielen, die Innenecke des gelben Clavusteiles und die Clavusader von der Vereinigungsstelle bis zur Spitze. Die grünen Flügel sind durchscheinend, die gelben und roten Farbflecke aber dicht und undurchsichtig. Grösse, 6 bis 6.5 Millimeter mit angelegten Flügeln.

Mir lagen 6 Stücke vor von Luzon, Kalinga, Balbalan: Ifugao, Mount Polis, Haight's Place.

Taxilana simplex sp. nov.

Das ganze Tier gleichmässig grün, die Flügel durchscheinend; bei einigen Tieren der Hinterrand des Scutums rötlich. Grösse, 6 bis 7 Millimeter mit angelegten Flügeln.

Mir lagen 6 Stücke vor von Luzon, Kalinga, Balbalasang, Balbalan: Laguna, Mount Banahao: Benguet, Haight's Place.

Taxilana granulata Stål.

Diese Art lag mir zahlreich vor von Luzon und Mindanao.

Garumna lepida Melichar.

Diese Art lag mir vor von Mindanao, Zamboanga: Lanao, Port Banga, Momungan, Kolambugan.

[3] Monogr. d. Tropiduchinen, Verh. d. natf. Ver. Brünn 53 (1915) 172.

Subfamilia LOPHOPINÆ Stål

Tribus ELICAINI Melichar

Epiptyxis plagiata sp. nov.

Der *E. serrata* Hpt. von Celebes (Minahassa) sehr ähnlich.[4] Scheitel nur zur Hälfte seiner Länge die Augen überragend. Gelbbraun; Spitze des Kopfes, zwei Punkte vor dem Hinterrande des Scheitels, hintere Hälfte des Pronotums, Mitte des Scutums, Vorderrand und Spitze der Vorderflügel (abgesehen von der hellen Zeichnung) und Clavus dunkler, Kiele heller; hell ockergelb sind der grössere untere Teil der Stirn und die Vorderbrust; Costalrand mit zahlreichen parallelen helleren Querstrichen, die bis zum Radius reichen, nach der Flügelspitze zu grösser werden, weiter auseinanderstehen und allmählich so sehr aufhellen, dass die letzten fünf fast hyalin sind; ausserdem sind im Spitzenteil die Queradern aufgehellt. Hintere Aussenecke der Vorderflügel gleichmässig abgerundet, bei *E. serrata* fast rechtwinklig mit abgerundeter Spitze. Neben den Seitenkielen der Stirn keine Körnchen. Grösse, 11 Millimeter mit angelegten Flügeln.

Zwei Stücke von Mindanao, Zamboanga, Port Banga.

Bemerken möchte ich noch, dass weder bei dieser Art noch den andern bis jetzt bekannten Arten die Stirnkiele an der Stirnbasis miteinander verbunden sind, es sei denn, dass Melichar den Stirngipfel mit "Basis" bezeichnet.

Tribus LOPHOPINI

Lophops carinata Kirby.

Diese Art var in 1 Stück vertreten; Mindanao, Zamboanga, Port Banga.

Subfamilia ISSINÆ Spinola

Tribus HEMISPHAERINI

Hemisphaerius variegatus Stål.

Ein Stück, Mindanao, Lanao, Momungan.

Hemisphaerius tristis Stål.

Sechs Stücke, Mindanao, Lanao, Momungan; Luzon, Buranon. Bis jetzt nur von Batjan bekannt.

Hemisphaerius sexvittatus Stål.

Vier Stücke von Mindanao, Surigao, Surigao; Südost Luzon; und Siargao, Dapa.

[4] Stett. Ent. Ztg. 78 (1917) 308.

Hemisphaerius chlorophanus Melichar.

Zahlreiche Stücke von Luzon; 2 Stücke, Mindanao, Lanao, Kolambugan, Momungan.

Hemisphaerius coccinelloides Burman.

Zehn Stücke, vorliegend von Luzon, Benguet, Trinidad; sonst noch von Bataan, Limay, und Nueva Vizcaya, Imugan.

Tribus ISSINI

Capelopterum luzonensis sp. nov. Tafel 1, Fig. 1.

Grundfarbe olivgrün, die kleinen Lücken zwischen den vielfältig verzweigten Netzadern innerhalb der Zellen braungelb, weitere vorhandene Flügelzeichnung sehr variabel: meist sind 5 bis 7 elfenbeinweisse Punkte vorhanden (beim Weibchen!), die sich auf die Flügelmitte verteilen und von denen 3 an der Grenze des ersten Flügeldrittels in einer Querreihe stehen. In der Nähe der Sutura clavi befindet sich zuweilen ein sammtschwarzer Fleck, wie bei *C. bimaculatum* Melichar. Bei einem der Männchen liegt dieser schwarze Fleck inmitten einer dreieckigen Binde, die aus schwarzen Flecken besteht. Diese Binde ist dreieckig, innen umfasst sie die beiden Schlussrandhöcker, nach vorn spitzt sie sich zu und erlischt am Radius; das Schulterdrittel ist bei diesem Männchen rötlich angehaucht und trägt auf seiner Mitte einen dunklen Fleck. Zuweilen sind auch die Clavusadern und die Adern gegen den Rand gerötet. Die Weibchen sind dunkler gefärbt, mehr braun als grün. Seitenecken des Scutums braun gefleckt. Bei Kopf, Pronotum, Brust, und Beinen erscheint die Grundfarbe bräunlich, mit zahlreichen grünen Punkten besetzt, die besonders an den Beinen deutlich hervortreten.

Männchen.—Genitalklappen am Grunde bauchig gerundet, doppelt so breit als in der halsartigen oberen Hälfte, oben nach innen geknickt, zugespitzt, und am Ende mit einem Widerhaken versehen, dessen Spitzen abgestumpft erscheinen. Hypopygium nach dem Ende zu verdünnt und leicht nach unten gebogen.

Grösse, 5.5 bis 7 Millimeter.

Mir liegen 10 Stücke vor, 6 Männchen und 4 Weibchen; Luzon, Benguet, Trinidad: Laguna, Mount Banahao.

Diese Art hat grosse Aehnlichkeit mit *C. bimaculatum* Melichar von Neu-Guinea. Die Gattung scheint ausschliesslich der Inselbrücke Neu-Guinea–Philippinen anzugehören. Als mit der Gattung verwandt, aber entschieden nicht hingehörig, sehe ich *C. dohrni* Mel. von Java und *C. sellatum* Mel. von Ceylon an.

Tonga acutipennis sp. nov. Tafel 1, Fig. 2.

Kopf, Pronotum, Scutum, Brust, und Beine braun, Abdomen dunkelbraun; Vorderflügel olivgrün, von den Rändern her leicht gebräunt, die Costa etwas dunkler; Hinterflügel leicht getrübt, mit grünlichen Adern. Kopf so lang wie Pronotum und Scutum zusammen, Scheitel fast bis zur Spitze mit sehr feiner Längsfurche; Ende des Kopfes (seitlich!) zugerundet, mit kurzem Dorn versehen. Stirn glatt, Seitenkiele fast durchlaufend, Mittelkiel nur oben vorhanden. Kopfende schwarz; der kurze Mittelkiel ganz, die Seitenkiele der Stirn bis zur Mitte, die Seitenkiele des Scheitels nur am Anfang geschwärzt. Pronotum mit Mittelkiel (beiderseits davon mit eingestochenem Punkt), sein Saum grob gerunzelt, die Mitte fast glatt. Scutum mit Mittelkiel und angedeuteten Seitenkielen. Vorderflügel gleichmässig, Steinpflaster ähnlich, genarbt, Suturalecke ziemlich schlank zugespitzt (etwa 50°!).

Männchen.—Genitalplatten am Grunde bauchig nach unten gewölbt, von da an allmählich verschmälert, im letzten Drittel rund nach innen umgebogen, das Ende fast S-förmig gekrümmt. Forceps zweiteilig: unterer Teil spitz, oberer Teil länger, kräftiger und zugerundet.

Grösse, 15.5 Millimeter mit angelegten Flügeln.

Ein Männchen von Südost Luzon.

Tonga irregulata sp. nov.

Körper hellbraun; Flügel olivgrün, von der Schulter her bis etwa zur Mitte leicht gebräunt, Adern gegen das Ende stärker hervortretend, vor allem im Vergleich zu der Ausfüllung der Zellen, die locker und unregelmässig ist und kein solch geschlossenes (Steinpflaster ähnliches) Muster bildet wie etwa bei der vorhergehenden Art oder wie bei *T. inermis* Stål. Kopf um ein Viertel länger als Pronotum und Scutum zusammen; Scheitel mitten glatt, ohne Spur eines Kieles; Ende des Kopfes (seitlich!) schlank zugespitzt, in einen Dorn auslaufend, Stirn mit durchlaufendem Mittelkiel, der sich auf dem Clypeus fortsetzt, und Seitenkielen, die etwas vor dem Clypeus verlöschen. Zugespitztes Kopfende unten, Seitenkiele der Stirn bis zur Mitte und Mittelkiel nur ganz oben schwarz. Schwarz sind ebenfalls die Kanten an den Schienen der beiden vorderen Beinpaare. Pronotum mit Mittelkiel und eingestochenen Punkten zu beiden Seiten des Kieles, an den Seiten grob gerunzelt. Scutum mit Mittelkiel? (durch die Nadel demoliert!), Seitenkiele angedeutet.

Vorderflügel ebenso schlank zugespitzt wie bei *T. acutipennis*, Suturalecke etwa 50°. Grösse, 17 Millimeter mit angelegten Flügeln.

Ein Weibchen, Siargao, Cabuntug.

Tonga semipolita sp. nov. Tafel 1, Fig. 3.

Körper zwischen hellbraun und olivgrün; Beine hellbraun, die Kanten an den Schienen der beiden vorderen Beinpaare schwarz; Flügel olivgrün, von der Schulter gegen die Mitte mehr oder weniger gebräunt und etwa bis zur Mitte glänzend glatt, ohne Narbung. Kopf so lang wie Pronotum und Scutum zusammen, vorn schwarz, mit kurzem Dorn, kurz zugespitzt, unterhalb des Dornes neben den Seitenkielen jederseits mit je einem schwieligen Knötchen, das bei keiner andern der hier genannten Arten so deutlich hervortritt als bei dieser Art. Scheitel mit undeutlich begrenztem gelblichen Längsstrich auf der Mitte. Pronotum mit mittlerem Längskiel, daneben 2 eingestochene Punkte, im übrigen grob punktiert, besonders an den Rändern. Scutum mit Mittelkiel, im übrigen glatt. Stirn mit durchlaufendem Mittelkiel, der sich bis auf den Clypeus fortsetzt, Seitenkiele ebenfalls durchlaufend, die Kiele von oben her mehr oder minder geschwärzt oder auch nicht geschwärzt. Costalrand der Vorderflügel etwa in der Mitte stumpfwinklig nach vorn gezogen, wodurch die Flügel trapezoidischen Umriss erhalten, Suturalecke fast rechtwinklig, dem rechten Winkel mehr genähert als bei *T. inermis*.

Männchen.—Genitalplatten am Grunde wenig bauchig vorgewölbt, fast gleichbreit, am Ende rechtwinklig umgebogen zu einem dünnen, gestreckten Fortsatz. Forceps unten einen schlanken Dorn bildend, von dem sich nach oben eine segelartige Spannhaut zieht.

Grösse, 14 bis 18 Millimeter mit angelegten Flügeln.

Mir liegen 5 Stücke vor von Luzon, Nueva Vizcaya, Imugan; Kalinga, Balbalan; und 1 Stück von Polillo.

Tonga inermis Stål. Tafel 1, Fig. 4.

Diese Art liegt mir in 8 Stücken vor von Luzon, Ilocos Norte, Bangui: Benguet, Trinidad. Um die Unterscheidung der Arten künftig zu erleichtern, bilde ich das Genitalsegment der Männchen ab.

Männchen.—Genitalplatten unten bauchig vorgewölbt, nach oben allmählich verschmälert, oben fast rechtwinklig zu einem

wenig verschmälerten Fortsatz umgebogen. Forceps zweiteilig: der untere Fortsatz lang, gleichbreit, am Ende kurz rechtwinklig aufgebogen, nach hinten gerichtet, der am Grunde stehende zweite Fortsatz kurz, am Ende etwas erweitert, nach oben und innen gerichtet.

Tribus THIONINI

Tetrica tricarinata Stål.

Es liegen mir 9 Stücke vor von Luzon, Benguet, Haight's Place: Ifugao, Mount Polis: Nueva Vizcaya, Imugan: Kalinga, Balbalasang: Laguna, Los Baños.

Tetrica maculipennis Stål.

Es liegen mir 5 Stücke vor von Mindanao, Surigao, und Siargao, Dapa.

Syrgis acutus Walker.

Es liegen mir 3 Stücke vor von Samar, Catbalogan; Mindanao, Lanao, Momungan, und Polillo.

Subfamilia FLATINÆ Spinola

Tribus RICANIINI A. S.

Ricania speculum Walker.

Mir liegen zahlreiche Stücke vor von den verschiedensten Fundorten auf Luzon, Mindanao, und anderen Inseln des Archipels. Die Flecken auf den Vorderflügeln wechseln so sehr in Grösse und gegenseitiger Verbindung, dass ich nicht wagen kann die Philippinen-Formen irgend einer der schon beschriebenen "Varietäten" zuzuteilen oder als neue Form zu beschreiben.

Ricania proxima Melichar.

Diese von Hinterindien her über den indischen Archipel verbreitete Art fehlt also auch nicht auf den Philippinen. Mir liegen 7 Stücke vor von Luzon, Laguna, Los Baños, und Manila; Mindanao, Zamboanga, Port Banga.

Ricania stupida Walker.

Sehr zahlreich von Luzon, Polillo, und Mindanao.

Ricanoptera mellerborgi Stål.

Mir liegen 5 Stücke von Polillo vor. Ich spreche die Stücke als besondere Form an, da der grosse Fleck in der Mitte der Vorderflügel sehr ausgezackt ist und im Innern einige dunkle Stellen zeigt, so dass es den Anschein hat, als wolle er sich in mehrere kleine Flecken auflösen. Ich nenne sie Forma reducta n. f.

Scolypopa aeneomicans sp. nov.

Nervus radialis und subradialis entspringen mit einem gemeinschaftlichen Stiel aus der Basalzelle. Stirn hell ockergelb, mitten längsgerunzelt und grob punktiert, an den Seiten fast glatt. Clypeus an den Seiten mit feinen braunen Schrägstreifen. Scheitel quer, sehr schmal, mit feinen Längsrunzeln. Pronotum doppelt so lang als der Scheitel, mit feinem Mittelkiel, vorn flachbogig vorgezogen, hinten flachbogig ausgeschnitten, mittleres Drittel fast gleichbreit, Seitendrittel hinter den Augen fast um die Hälfte verschmälert. Scutum lederartig, vorn mit Querkiel, Mittelkiel fein und hinten abgekürzt, Seitenkiele bogenförmig, vorn und hinten abgekürzt. Vorderflügel hell ockergelb mit dunkelbrauner Zeichnung und fast milchweissen Randflecken. Dunkelbraun ist eine keilförmige, nach hinten zugespitzte Querbinde hinter dem Basaldrittel und das Apicaldrittel. Der erste der weisslichen Randflecke liegt auf der Mitte des Vorderrandes, der zweite zwischen diesem und der Spitze, der dritte, sehr kleine Randfleck liegt dicht vor der Spitze; in der oberen Hälfte des Apicalrandes liegen dicht bei einander zwei kleine dreieckige Flecken. Die hellen Stellen des Vorderflügels sind fast hyalin; die dunkeln Stellen sind hier und da fleckenartig aufgehellt und zeigen in schrägem Lichte kupferigen Metallglanz. Hinterflügel leicht getrübt mit angedunkeltem Saum, dieser Saum nach der Analzelle zu verbreitert. Vorderkörper dunkelbraun, Hinterleib, Stirn, Brust, und Beine hellbraun. Hinterschienen mit drei Dornen, der obere Dorn sehr klein. Grösse, Körper, 6 Millimeter; Spannweite, 17 Millimeter.

Ein Weibchen von Luzon, Kalinga, Lubuagan.

Alisca tagalica Stål.

Ein Weibchen von Polillo.

Alisca circumpicta Stål.

Ein Weibchen von Luzon, Bataan, Limay.

Mindura subfasciata Stål.

Mir liegen 12 Stücke vor von Luzon und Mindanao, Surigao, Surigao.

Tribus FLATINI Spinola

Flata floccosa Guerin.

Zahlreich von Mindanao, Surigao, Surigao.

Flata subguttata Stål.

Vier Stücke von Mindanao, Surigao, Surigao.

Cerynia albata Stål.

Drei Stücke von Mindanao, Surigao, Surigao.

Bythopsyrna leucophaea Stål.

Sehr zahlreich von Mindanao, Surigao, Surigao.

Phyma guttifascia Walker.

Die bis jetzt von dieser Art beschriebenen "Varietäten" sind nur als Aberrationen anzusprechen. Ich könnte eine neue Aberration hinzufügen, bei der Diagonalstrich, Schlussrandsaum, und Punktreihen am Apicalrande sich in breite schwarzbraune Streifen verwandelt haben (1 Weibchen von Polillo). Ich nehme an, dass sich mit der Zeit noch viel mehr Abänderungen finden werden, die alle ineinander übergehen. Ausser dem genannten Stück lagen mir noch drei andere vor von Samar, Catbalogan; Mindanao, Surigao, Surigao; Zamboanga, Zamboanga.

Mesophylla inclinata Melichar.

Zahlreich von Luzon, Laguna, Mount Banahao (nur 1 Stück!) Los Baños: Manila; Kalinga, Lubuangan, Balbalan; Bataan, Limay; Catanduanes, Virac; Mindoro, Zamboanga, Lubaan.

Colgar calochroma Walker.

Sehr zahlreich vorhanden. Flecken zum Teil sehr bleich und kaum sichtbar bis orangegelb, Ränder der Vorderflügel ungefärbt oder mehr oder minder intensiv kirschrot.

LUZON, Laguna, Mount Banahao. CAMIGUIN, bei Mindanao.

Subfamilia ACHILINÆ Stål

Eine absolut sichere Definition für diese Subfamilie scheint noch zu fehlen, und es ist mir auch nicht möglich, an dieser Stelle eine zu geben. Hauptmerkmal scheint die eigenartige Form der Vorderflügel zu sein, bei denen der Innenrand bis zur Clavusspitze geradlinig verläuft, dann aber stumpfwinklig abbiegt, so dass in der Ruhelage die Innenecken der Membran übereinander greifen. Der Scheitel kann von der Stirn abgegrenzt sein oder völlig glatt in diese übergehen.

Cythna glabra sp. nov. Tafel 1, Fig. 5.

Stirn länglich, im unteren Drittel am breitesten, hier etwa halb so breit als lang, mit dem Clypeus zusammen gestrecktlanzettförmig, mit durchgehendem scharfen Längskiel, neben den Augen sehr leicht verengt. Scheitel um die Hälfte seiner Länge die Augen überragend mit scharfem Mittelkiel und schar-

fen Seitenkielen, die sich vorn in einem Spitzbogen vereinigen. Pronotum tief winklig ausgeschnitten mit drei deutlichen Längskielen, Seitenlappen mit zwei schwachen Längskielen hinter den Augen. Scutum rhombisch, mit drei Längskielen, die fast parallel verlaufen und in einer Richtung mit den übrigen Kielen liegen. Vorderflügel durchscheinend mit deutlichen Adern; die innere Clavusader verläuft in der Richtung zur Clavusspitze, verlischt aber beim Beginn des letzten Viertels ihres Weges, kurz vorher ist sie durch eine gerade Querader mit der inneren Clavusader verbunden. Die Apicalzellen nehmen von innen nach aussen zu stufenförmig ab, die innerste Zelle ist dreimal so lang als die äusseren Zellen.

Farbe gelbbraun. Seiten der Stirn gegen die Spitze leicht gerötet, Ocellen rot, Stirngipfel leicht gebräunt, Scheitel in den Vertiefungen braun. Vorderflügel im ganzen heller als die übrigen Körperteile, schwach glänzend, ohne Körnchen auf den Adern und ohne Haare, die kurze Clavusquerader weiss, die Apicalzellen am Saum gebräunt. Alle Kiele etwas heller als der Untergrund. Grösse, 5 Millimeter.

Ein Stück von Mindanao, Surigao, Surigao.

Tangina (=Eurynomeus Kirkaldy) modesta sp. nov.

Stirn und Clypeus mit durchgehendem Mittelkiel, dicht über dem Clypeus stumpfwinklig verbreitert. Kopf von oben gesehen gleichmässig gerundet, Scheitel nur wenig vortretend, in der Mitte und an den Seiten nur schwach gekielt. Pronotum tief, gerundet-stumpfwinklig ausgeschnitten, Mittelkiel deutlich, die schrägen Seitenkiele wenig deutlich. Scutum hinten spitzer als vorn, mit drei parallelen schwachen Längskielen. Vorderflügel durchscheinend mit deutlichen glatten Adern, mattglänzend.

Farbe hellbraun. Spitze des Kopfes gebräunt. Pronotum und Vorderflügel trüb-gelblich; zitronengelb sind zwei Flecken auf dem Scutum neben den Seitenkielen und ein Streif des Clavus neben dem Scutum. Grösse, 5 Millimeter.

Ein Stück von Mindanao, Lanao, Kolambugan.

Tangina quadrilineata Melichar.

Liegt mir zahlreich von Mindanao vor.

Callinesia maculinervis sp. nov. Tafel 1, Fig. 6.

Kopf die Augen nur wenig überragend; Stirn länglich mit durchlaufendem scharfen Mittelkiel, Randkiele scharf, gehoben,

grösste Breite etwas unterhalb der Mitte, 2.5 mal so lang als breit, oben halb so breit als bei der Mitte; Scheitel ähnlich einer Pfeilspitze mit scharfem Mittelkiel, der die Spitze nicht erreicht, die Ränder stark gehoben und geschärft. Pronotum hinten rechtwinklig ausgeschnitten, mitten mit drei scharfen Kielen, von denen die beiden seitlichen divergieren; hinter den Augen noch zwei abgekürzte kaum merkliche Kiele gegen die Tegulae. Scutum mit drei scharfen Kielen, die Seitenkiele etwas divergierend. Vorderflügel mit scharf hervortretenden Adern; äussere Clavusader vor ihrer Vereinigung mit der inneren mit der Clavusnaht durch eine Querader verbunden; im Corium drei Sectoren, der mittlere und äussere mit gemeinsamem kurzen Stiel, der innere und äussere etwas oberhalb der Mitte gegabelt, die inneren Gabeläste im unteren Drittel mit dem mittleren Sector durch Queradern verbunden; an der Spitze sind zehn fast gleichlange Apicalzellen vorhanden.

Farbe gelblich-braun. Stirn unregelmässig braun gefleckt (marmoriert), an den Seitenkielen gelblich punktiert, unterhalb der Erweiterung mit gelblichem Querband. Scheitel mitten quer dunkelbraun, ebenfalls dunkelbraun die Spitze und die hinteren Ecken; Pronotum unregelmässig braun gefleckt. Scutum ganz dunkelbraun, nur die Kiele heller; im vorderen Drittel die Seitenkiele mit dem Mittelkiel jederseits durch einen gebogenen schmalen Querstreif verbunden. Vorderflügel auf hellbraunem Grunde dunkel gefleckt; die Flecken gehen stets von den Adern aus, auf denen sie am dunkelsten sind, so dass die Adern abwechselnd hell und dunkel gefärbt erscheinen. Beine hellbraun, Schenkel und Schienen mit je zwei dunkelbraunen Ringen. Grösse, 5 Millimeter.

MINDANAO, Surigao, Surigao: Lanao, Momungan.

Genus **WINAWA** novum

Scheitel die Augen nur wenig überragend, breit, glatt, ohne Kiele, mit gleichmässiger Rundung in die Stirn übergehend; Stirn mit schwachem Mittelkiel, der auf der Rundung zum Scheitel verlöscht, unterhalb der Mitte etwas verbreitert, von dieser Stelle ab zum Clypeus spitz zulaufend, so dass sich jederseits eine stumpfe Ecke bildet. Scheitel hinten sehr flachbogig ausgeschnitten; Pronotum hinten stumpfwinklig ausgeschnitten mit drei Längskielen. Scutum quer-rhombisch, leicht gewölbt, mit drei fast parallelen Längskielen, hinten mit gehobenem Rand. Vorderflügel mit zwei Sectoren; der innere gabelt sich nahe der Clavusspitze, der äussere nahe der Schulter; der äus-

sere Gabelast des letzteren gabelt sich nochmals etwa in der Mitte des Flügels und sendet eine gebogene Ader zur Stelle des Stigmas. Die Apicalzellen sind innen am längsten und nehmen nach aussen sehr schnell an Grösse ab. Durch eine Stufenader, die zum Stigma zieht, werden unterhalb der Flügelmitte drei gleichgrosse Discoidalzellen abgegrenzt. Clavus mit zwei Adern, die sich nahe der Spitze vereinigen.

Winawa bicolor sp. nov. Tafel 1, Fig. 7 und 8.

Farbe schokoladenbraun und chromgelb. Gelb sind: eine Binde über die breiteste Stelle der Stirn, die sich bis auf die Wangen verlängert, zwei feine Striche auf dem Scheitel neben den Augen, die äusserste Spitze des Scutums, und zwei keilförmige Binden auf den Vorderflügeln; die obere Binde liegt im vorderen Drittel des Flügels, liegt mit ihrer Spitze am Costalrande in gleicher Höhe mit der Spitze des Scutums und verbreitert sich nach innen bis zur Vereinigung der beiden Clavusadern; die zweite Binde liegt mit ihrer breitesten Stelle am Costalrand etwas unterhalb der Flügelmitte und berührt das Stigma, nach innen spitzt sie sich zu, läuft mit ihrem unteren Rande der oberen Grenzader der Discoidalzellen parallel und erreicht mit ihrer Spitze den äusseren Gabelast des inneren Sectors. Gelb sind ferner an den Hinterbeinen die Kniee und die unteren Hälfte der Schienen. Der ganze übrige Körper dunkelbraun mit Ausnahme der hellen Hinterbrust; Vorderflügel gegen das Ende heller gebräunt. Grösse, 5 Millimeter.

MINDANAO, Lanao, Kolambugan.

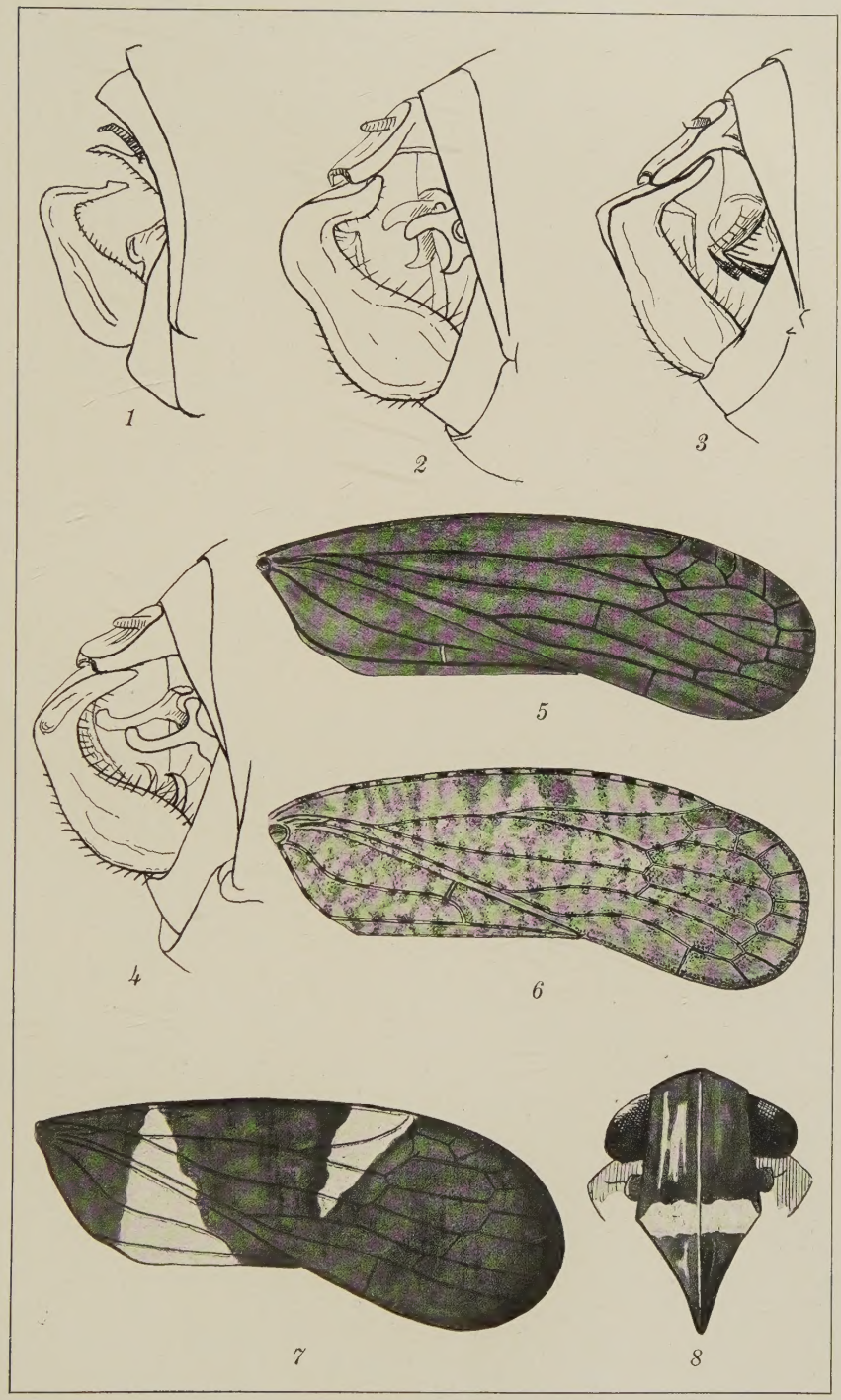
Im Anschluss hieran möchte ich bemerken, das es sich bei den Gattungen *Cythna* und *Callinesia* von den Philippinen vermutlich um neue Gattungen handelt, da sie augenscheinlich, vor allem wegen des Clavusgeäders, mit jenen des australischen Faunengebietes nicht übereinstimmen.

ILLUSTRATIONEN

[Zeichnungen von H. Haupt.]

Tafel 1

Fig. 1. *Capelopterum luzonensis* sp. nov.
2. *Tonga acutipennis* sp. nov.
3. *Tonga semipolita* sp. nov.
4. *Tonga inermis* Stål.
5. *Cythna glabra* sp. nov.
6. *Callinesia maculinervis* sp. nov.
7. *Winawa bicolor* sp. nov.
8. *Winawa bicolor* sp. nov.



TAFEL 1.